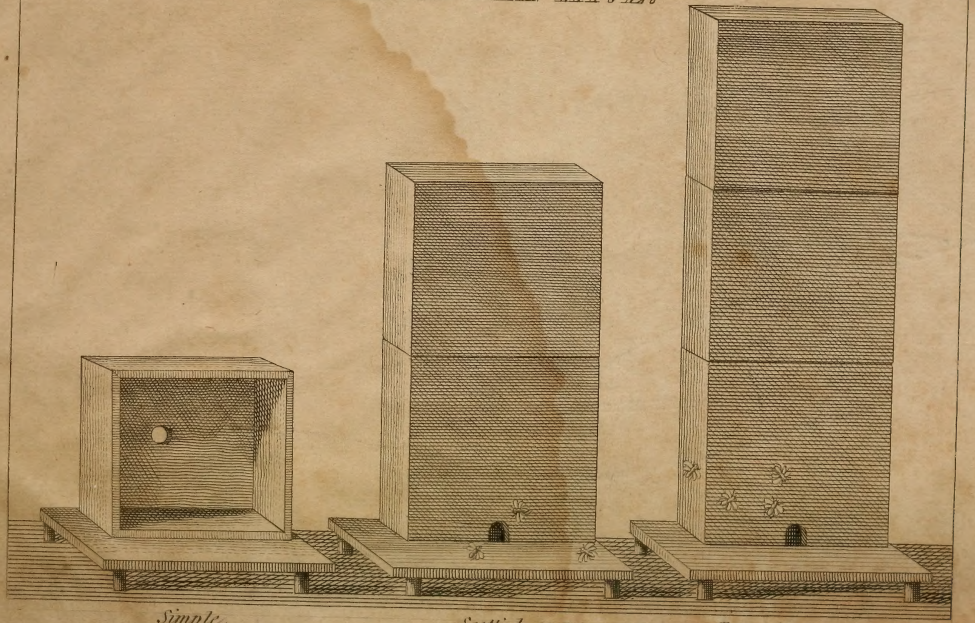
IMPROVED BEE-HIVE.



Simple. *Scottish.* *Pyramidal.*

THE

PYRAMIDAL BEE-HIVE:

A

Plain and Natural Method

OF

PRESERVING AND PERPETUATING

THE

POPULATION OF BEES,

AND OF

RECEIVING ANNUALLY, FROM EACH FAMILY,

A BOX FULL OF

WAX AND PURE HONEY,

WITHOUT DISTURBING THE BEES, OR DESTROYING THE COUVAIN;

AND THE ART OF RESTORING HIVES,

(WHOSE POPULATION HAS PERISHED)

BY HATCHING THE EGGS, REMAINING IN THE CELLS,

BY THE

Heat of the Sun.

ALSO, THE

ART OF CONVERTING HONEY

INTO

WHITE, INODOROUS SUGAR,

AND OF MAKING

HYDROMEL, SIRUPS, &c.

A WORK USEFUL TO FARMERS.

BY P. DUCOUÉDIC,

PRESIDENT DU CANTON DU MAURE, DEPARTMENT D'ILLE-ET-VILAIN.

Lætitiam, laudem, copiam, hinc sperate coloni.

ABRIDGED, AND TRANSLATED FROM THE FRENCH,

BY SILAS DINSMOOR.

PHILADELPHIA:

CAREY, LEA & CAREY.

1829.

Eastern District of Pennsylvania, to wit:

BE IT REMEMBERED, that on the twenty-seventh day of May, in the fifty-third year of the independence of the United States of America, A. D. 1829, *Silas Dinsmoor*, of the said district, has deposited in this office the title of a Book, the right whereof he claims as Proprietor, in the words following, to wit:

"The Pyramidal Bee-hive: a plain and natural method of preserving and perpetuating the population of bees, and of receiving annually, from each family, a box full of wax and pure honey, without disturbing the bees, or destroying the couvain; and the art of restoring hives, (whose population has perished,) by hatching the eggs, remaining in the cells, by the heat of the sun. Also, the art of converting honey into white, inodorous sugar, and of making hydromel, sirups, &c. A work useful to farmers. By. P. Ducouëdic, President du Canton du Maure, Department D'Ille-et-Vilain.—Lætitiam, laudem, copiam, hinc sperate coloni.—Abridged, and translated from the French, by Silas Dinsmoor."

In conformity to the Act of the Congress of the United States, intituled, "An Act for the encouragement of learning, by securing the copies of maps, charts, and books, to the authors and proprietors of such copies, during the times therein mentioned"—And also to the Act, entitled, "An Act supplementary to an Act, entitled, 'An Act for the encouragement of learning, by securing the copies of maps, charts and books, to the authors and proprietors of such copies during the times therein mentioned,' and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints."

D. CALDWELL,
Clerk of the Eastern District of Pennsylvania.

DEDICATION.

Procul! ô procul este profanæ!—SIBYLL.
Anglicé—Sluts, keep your distance!

If there be such a monster in our happy country, as a *slattern*, too indolent to pick up the blessings of heaven, though scattered as thick as blackberries around her,—she is strictly forbidden, even to touch this book, under the penalty of our everlasting displeasure. But to that sober, discreet, intelligent, cheerful, active, industrious, economic class of MATRONS, who *love their lords*, whose gardens are a *paradise* and homes a *heaven*, —to that class, *who were from the beginning, are now, and ever shall be, crowns of glory to their husbands*,—this little work is respectfully dedicated, by their most devoted friend and humble servant,

THE TRANSLATOR.

PREFACE.

This little Manual is abridged and translated from a popular and practical treatise on the culture and management of Bees in France, examined *theoretically* and *experimentally*, and *approved* by the agronomic societies, and the public authorities of the departments. The author does not pretend to absolute originality in his work, but says that, like the Bee, he has extracted the nectar and essence from every preceding treatise on the subject; and by accurate observations, and laborious experiments, he has obtained the most happy and satisfactory results.

Believing that I could not render a more acceptable service to that class of the community to whom it is dedicated, particularly in the interior and western districts, I have put it into a plain country dress, and offer it to their notice and matronage, on its own merits, without any apology for its style.

SILAS DINSMOOR.

OF THE PYRAMIDAL, OR THREE-STORIED

BEE-HIVE.

An Improvement of the Hive of M. De la Bourdonnaye, by adding a Third Story.

CHAPTER I.

ON THE INVENTION OF THE PYRAMIDAL HIVE.

From the earliest antiquity, zealous bee raisers have successively formed different systems for the management of those insects; but hitherto no one has discovered the solution of the problem, how to rob them of their annual produce without destroying them in whole or in part. In fact, no one has found out the means of annually profiting by the labours of these precious insects, without the preliminary of a total or a partial destruction, by smoking, castration, or driving,—all of which destroy a large portion, and often the whole of the *couvain*, as also the colony itself.

Making minute observations on the instinct and architecture of these insects, and following methodically the steps of M. De la Bourdonnaye, in his experiments on his hive, I discovered the secret of nature—how to obtain a complete annual harvest of the products of bees, without causing them the smallest prejudice.

When the bee, in a wild state, selects a retreat in the hollow of a tree or cleft of a rock, it always fixes on the upper part of the hollow or cleft, to build and suspend its combs. These edifices, bound and suspended to each other, always wrought from the top downward, and never from the bottom upward,—are continued descending, as long as the bee finds empty space to work in.

The bees, continually and invariably labouring downward, abandon their first made combs above, and occupy the new built combs below, where the queen mother, having also descended, deposits her new couvain, under the guardianship of the whole colony. In the second year, therefore, there are no *bees* in the upper tier of combs;

they are without *couvain* of any kind, and completely filled with honey.

Such is the habit of bees in their wild state, and such is it also in their domestic state. Instinctively they build from the top downwards, and move successively from the higher to the lower combs; and precisely in the same manner should man look for the art of despoiling them, without injury: without smoking, castrating, transvasing, or driving them.

It is evident, that if we intend to rob bees, thus lodged in a hollow tree or cleft rock, without injuring them, we must attack their store at the top. There the combs will be easily removed, because the bees have left them, and are busily engaged in the lower part of the hollow or crevice, and do not even perceive the larceny; nor do they suffer by it, because these upper combs become superfluous by the new provisions which they instinctively accumulate, in their uninterrupted descending operations.

The manner in which the wild bees work in hollow trees or in clefts of rocks, is the same as that of domestic bees, in their artificial hives or boxes: they always begin at the top of the box, and work downward.

Here the whole secret of nature is unveiled—how to rob bees without doing them the least injury. From this habit of bees in their wild state, I took the hint of forming the *pyramidal* hive, or hive of three stories; by placing, each succeeding spring, a box under the preceding one; the upper box or story of which, full of honey or wax, without egg, larva, chrysalis, or fly, will be every year at the disposal of the proprietor. Because the bees have abandoned that upper story, and carry on their labours below where the queen mother is stationed with her family and young.

This secret, snatched as it were from nature by the work of M. De la Bourdonnaye, whose steps I have followed only to complete his plan, is within the reach of *every farmer*. It is only necessary, that in the spring, he put a new box under the simple hive, that the bees, after having filled the first, may descend and fill the second box. In the second spring, he is to put a third box under the two others, and in the autumn following the upper box is to be removed. Thus, in each successive spring, he will put a third empty box under the two others which remained on the bench, and in the autumn take a full box from the top.

This method, drawn from nature, is infallible. The upper box is always filled with wax and honey, without bees or young of any kind, and entirely free from ordure. The whole colony has descended from the first pannier into the second, which becomes the upper as soon as the first is removed. The queen mother, her colony, and all her young, are settled in the second story, and if the season be favourable, the bees will sometimes begin to make combs in the third or under story.

The upper story, when removed, contains only virgin honey, made the preceding spring; because the bees usually consume, during autumn and winter, the stock of the foregoing season.

Every farmer could easily convert his honey into coarse sugar, which could be as easily refined as the sugar made from cane.

The pyramidal hive is known, and in use, in different parts of France, but principally in Brittanny, the Seine, and contiguous departments, and will soon become *general*, because simple and easy.

CHAPTER II.

OF THE BEE IN GENERAL.

It is not here intended to give a list of the different species of bees, which the Author of nature has spread over creation. The common bee or honey-fly (in Latin, *apis*) is an insect of the order of flies, of four wings. They live in society. Man has subjected them to his domain, to profit by their industry: he collects them into boxes or panniers, which he calls hives, and which differ in form and size in different countries.

The order which prevails in the different functions of domestic bees,—their government, industry, ingenuity in their works, and the utility of their labours,—have attracted the attention of ancient and modern observers. Some have spent a considerable part of their lives, in the study of their history and economy; and some, carried away by enthusiasm, have imputed to them false and extravagant qualities. Swammerdam, Miraldi, and Réaumur, by discarding these falsehoods and absurdities, and

adding new and curious facts, have rendered the history of bees more interesting.

Bees are the most active and industrious of all insects. In countries where perpetual spring reigns, they labour from the dawn of morning till the twilight of evening. In temperate climates, they are occupied nine months in the year; and even in winter, there are only a few days in which they seem to repose. It is only in high latitudes, where the bees cease to forage in the autumn and winter.

Even during winter, if the bees be not paralyzed by the cold, and some mild days permit them to consume a part of their provision, always industrious and provident, they are also employed in building new magazines, in which they can lay up new stores in summer, after first using them as deposits for the eggs of the queen, which have invariably the preference; for it belongs to the regular and immutable instinct of these insects, to use the cells as a deposit for the larvæ or eggs of the queen, at least once, before they are employed as stores for honey.

It is to these insects alone, which the Europeans are indebted for honey and wax, which form one of the most important branches of their rural economy. They collect the substances of which honey is composed, from all plants without exception; from the loftiest trees, to the most humble and simple shrubs—the forests and bramble brakes are equally their resort.

During the rising of the sap, all vegetables are very full of juice. These are all put in requisition by the bees: their only embarrassment is in the choice. Besides the juice of plants and the nectar of flowers, which they pump out of their calices without tarnishing their beauty, we frequently observe them busied on the bark and mosses of trees, where their piercing eyes and acute smell enable them to discover substances, which are doubtless necessary to season their honey. Sometimes they are observed on rocks, and on the sides of walls, where nothing is perceivable but the naked stone. There they seem to be collecting salts which are imperceptible to us. Water is indispensable for their subsistence, and instinct enables them to discover sources unknown to us.

The bee delights to *skip*, as it were, from flower to flower, and revel on their sweets. He sometimes rolls himself up in their folds, and always inserts his little proboscis into the calix of every flower on which he alights. He en-

riches himself with the spoil, and the eye of the *attentive observer* who follows him, will perceive the increase of the little balls of *pollen*, (food, necessary for the bees which work at home,) with which he fills the cavities on the hinder part of the thighs; but the eye can discover no alteration in the flowers. They lose nothing of their *beauty*, *aroma*, or *fecundity* *

In fine weather, whithersoever the bee directs his flight and pursues his researches, he is sure to find a more or less abundant supply of materials for his fabrics. These materials he sucks into his stomach, or places on his thighs, back, and wings, and flies still further to increase his booty. Such is his *ardour for amassing*, that he allows of no relaxation in his labours, till his load is complete, for his return to the hive.

As soon as the bee arrives at the hive, he discharges the contents of his stomachs, which are already converted into honey, wax, or propolis. He also discharges from his legs, back, and wings, the other substances which nature taught him, by rolling in flower cups, to collect and preserve for the nourishment of the interior working bees. No sooner has he discharged his burden, than he sets out to forage anew. His labour is without relaxation, from sunrise till sunset, during the whole summer.

Bees live in community. All those belonging to one hive, know each other, and never suffer strangers to join their society, except in the time of swarming, when several swarms may be united into one colony (*peuplade*) or family. Each colony is a monarchy, and has only one queen, to whom a thousand to eleven hundred drones (bourdons) are subordinate, as well as a multitude of working bees, more or less considerable, according to the extent of the colony.

All the working bees are armed, for their defence, with a *dart* or *sting*, fixed to the posterior extremity of the body. This weapon or sting is used at a *great risk;* it is generally left behind, and the wound thus occasioned to the bee, by tearing out the intestines to which the sting is annexed, is *always mortal.*

All bees, including the queen and drones, have two

* Our author observes, that in the French empire, millions and millions of swarms might subsist, without the smallest injury to the produce of any kind of harvest.

stomachs. In the first stomach, the nourishing substances are converted into honey. If this honey passes from the first into the second stomach, it is converted into *wax*, and even into *propolis* when needed. The labouring bees, in the working season, deposit the honey from their first stomach, into the cells of the combs, as a general stock. The queens and drones never return any thing but *wax*, which they discharge from their mouth like working bees.

In winter, bees generally live on the honey which the working bees provide in summer; but they may be fed on other materials, as sugar, molasses, sirups of fruits, &c. If a greater quantity of these articles be supplied than sufficient for immediate sustenance, the working bees will convert the redundance into honey, and lay it up for future use.

Bees know their keepers, and seldom attack them; otherwise, they are courageous and irritable little insects. They know the variations of the atmosphere: they group together, and rarely quit the hive when the weather is variable. When one is surprised abroad by a storm, it takes shelter under the branches or leaves of the nearest tree or shrub.

The ancients were acquainted with the great attachment which bees have for their *queen*, which they knew only by the name of *king*. Varro informs us, that they are constantly attentive to every thing which can contribute to her preservation. That they assist her flight, even so far as to support and carry her, when she appears too much fatigued.

It is impossible to know how long a bee can live. Fewer die of old age, than by storms, birds, wasps, moles, and other enemies. There is no disease known among them, except the dysentery, with which some swarms are occasionally, though rarely, affected. But if they have a wing, claw, proboscis, or any part whatever injured, so as to be useless, they are, without mercy, expelled the hive, where no invalid is suffered to remain, and they perish, victims of the voracity of other insects.

Their cleanliness in the interior of the hive, is singular. If a bee or embryo dies, it is immediately dragged out of the hive. They perfectly cleanse the cells (which are always first used as a deposit for the eggs of the queen) by removing the robes of the nymphs, and the envelopes of the worms, before they use them as stores for their honey.

M. De Réaumur observes that a snail, having crept into a hive in a cool night, was assailed by the bees, who stung it to death, but not being able to drag it out of the hive, had embalmed, and enveloped it in a cerement of propolis. "I (says our author) had occasion to remark this operation of the bees on a young mole, which had the temerity, and met the misfortune of the snail. It perished by the stings of the insects, and a short time after its death, I found it likewise enveloped in propolis."

Bees never discharge any excrement, as some authors maintain. They have no organ suited to such discharge. Every thing which enters the body of these insects, as nourishment, is returned by the mouth only, having been converted either into honey, wax, or propolis. Even when they have the disease which we call dysentery, they disgorge by the mouth, those substances which have *corrupted* in their stomach, instead of having been converted into honey, wax, or propolis.

The moderns, who have adopted this error, were doubtless led into the mistake, by supposing the small opening at the posterior extremity of the bees, to be an organ for the discharge of excrement; whereas it is only the orifice, or scabbard which encloses the sting.

These stings are fixed where other flies, who have their darts in the mouth, have the organ for the emission of excrements. The drone himself, who has neither dart nor sting for defence, discharges no excrement. The aliments which he takes, change into wax in the second stomach, and discharge by the mouth. The opening observed in his posterior extremity, is nothing but the orifice of the sheath of the organ proper for the fecundation of the queen's eggs. Finally, the queen herself discharges no excrements. Her aliments are converted into wax or propolis, which she discharges by the mouth. The orifice of the organ which we observe at her posterior extremity, is only used for laying eggs.

It is rare that a family of bees perish by the cold of winters, even the most rigorous, however few its population, if the hive be well closed, and sufficiently supplied with provisions. They are then grouped together, and appear buried in a profound sleep, during which, their provisions are economized till the moment of their waking. Some pretend, that in many countries of the north, in Russia, Sweden, Denmark, &c., to prolong their sleep, or

rather stupification, during the whole winter, the hives are put into ice-houses, where a uniform degree of cold preserves the bees. This may be true, but I would see the experiment tried, before I would recommend the custom in France, or other mild climates.

When the winter is mild, rainy, or interrupted with intervals of serene days, it is always disastrous to bees. They do not sleep as in severe winters. They consume their provisions, and are often in want before the return of spring and vegetation. They then experience a famine, most distressing, if the proprietor do not relieve them by a supply of aliment, till the revival of flowers. But now the loss of a family of bees is not so great as it was before the discovery of restoring them by hatching the eggs which remain in the cells, by the sole heat of the sun, or by using the boxes to put new swarms in, which will hatch the remaining eggs, and increase and strengthen the colony.

As soon as the egg is hatched, a worm comes out of it, or rather replaces it; and without quitting the cell, at the moment of its birth, begins to spin a robe to enwrap itself, in which it enlarges and becomes a nymph, by its own proper essence, without foreign aid. As soon as the robe is *finished*, the insect pierces *it*, and comes out in the form of a little bee. (While this insect is labouring, as it were, from *nothing* into *life*—from the state of an *egg* to that of a fly—it has no need of aliment. But at the instant of its birth, if he be weak, or the weather unfavourable for his flight to the fields, it requires nourishment; and it is *then* alone, that the working bees show a tenderness truly maternal, by lavishing on him those aliments, which are the most proper to advance his growth and perfection.)

The working bees are divided into two classes. The one class is occupied in the interior of the hive, to construct combs, and to connect and polish the cells. The other class goes out to forage. They have all, equally, the faculty to make honey, wax, and propolis. They are neither male nor female, for they are destitute of the facultative organs of procreation. Doubtless nature has thus disposed of them, to keep them in perpetual activity, which could not be, if maternal cares could draw them off from the daily labours, to which they are indispensably attached. Among these insects, every thing has a character, to distinguish them from all other beings in nature.

Each bee, as soon as he is divested of his nymphal robe, is perfectly acquainted with his individual duty. There is never the least disorder or confusion among them, in going out, or coming into their hives, in making or cleaning their cells, in filling them with honey, or in taking care of the young bees, newly released from their nymphal robes when weakness, or the inclemency of the weather prevents them from flying to the fields. Each knows his duty with an instinct more accurate, than easy to conceive. The prodigies of nature are wonderful in these insects. They are born, and instantly, without ulterior instruction, begin every necessary operation, whether to collect substances proper and necessary, or to convert those substances into honey, wax, or propolis, according to the wants of the family in the interior of the hive.

What shall we think, says the judicious M. Duchet, of that knowledge, so prompt and sure, by which bees distinguish their own hive from every other, and know ten thousand individuals of their own family, from a hundred thousand, or a million of neighbours, who do not belong to it, though all are perfectly alike? Here nature shows herself conspicuous. This knowledge is necessary to preserve themselves and their provisions, and was granted them by the Author of all things. The existence, and conduct of these insects, in their government, have excited the admiration of natural philosophers.

CHAPTER III.

OF THE QUEEN, OR MOTHER BEE.

The queen, or mother bee, holds the first rank in the colony. She is the mother of all the young, whether queens, drones, or workers, whether to keep up the numbers of the family at home, or for swarms to emigrate and form new establishments elsewhere.

The mother bees and drones, have no triangular pellets on their hinder legs, on which to deposite collections from the flowers abroad. The teeth of the queens, though smaller

than those of the working bees, are larger than those of the drones. They have no brush at the end of their claws. The queens are longer than the drones. You can easily discover them by the shortness of their wings, which do not extend beyond the third ring, whereas the wings of the other bees, and more particularly those of the drones, extend beyond the extremity of the body. The queen, on account of the shortness of her wings, cannot fly so easily as the working bees; hence it is, that during her whole life, she seldom makes use of them. In the interior of her body, the eggs are distributed in two ovaries. Each ovary is an assemblage of vessels, which terminate at a common canal, and which are all filled with eggs at the time of laying.

This is the result of the observations and reflections of Miraldi, Swammerdam, Réaumur, and Valmont de Bomare, concerning the mother bee; and the opinion of these celebrated men, ought to be sufficient authority to outweigh the ridiculous opinions advanced by the modern would-be philosophers,—the Boses and Féburiers, who assert that the queen bee is continually gadding abroad, and coursing over the fields, courting adventures of gallantry with every drone she meets.

I do not agree in opinion with these same moderns, (the Boses and Féburiers,) that the old queen is every year expelled the hive, by the colony itself, over which a young queen assumes the authority. These gentlemen are only cabinet, or green carpet philosophers. Had they ever stood by and examined a swarm coming out of a hive, they might have observed a young queen, scarcely divested of her nymphal robe, trying her wings, before risking her first flight. Sometimes obliged to return into the hive, for want of strength to take her departure; and that she is always obliged to stop, and rest on some tree, or bush, near the mother hive. This would not be the case, if the old queen had been driven out with the swarm.

It is not uncommon, in the country, to see a peasant seize a young queen, as she issues from an old hive, and put her into the new hive prepared for her, where the whole new swarm will settle around her. If she were an old queen, she would be more active and bold, and elude the grasp of the hand stretched out to arrest her.

The queen, which is longer than the common bee, and not quite so large as the drone, is endowed with an asto-

nishing fecundity, which is not equalled by any insect or animal, except some kinds of fish. The queen continues to lay as long as she can find places to deposite her eggs, for each requires a separate cell. These eggs are not fecundated till after they are laid: and this process is the same as that by which the roe of the female fish is impregnated by the male. It is not known how far the fecundity of the queen bee could extend, provided the working bees could furnish a sufficient number of cells, because she immediately lays as soon as she finds cells prepared to receive her eggs.

This phenomenon is very perceivable in the pyramidal hive, which produces swarms four or five times stronger than the simple hive; because there are an infinitely greater number of disposable cells for the queen to lay in. The multitude of working bees in the pyramidal hives, enables them soon to increase the extent of their combs, and the number of cells, and the deposite of the queen is more or less considerable in proportion to that number.

The queen is a stranger to coition. She is at once a virgin and a mother, notwithstanding the absurdities of some moderns, which it is not necessary to confute.

Every body knows, that the queen mother never leaves her family, nor goes out of the hive. In the centre of the cells, near the queen mother, some eggs are deposited, which produce new queens, destined to govern new swarms, or to succeed the old queen when she has finished her career. These young queens, as well as the old, are nourished by the family so long as they remain in the hive. The combats between the young queens and the old, mentioned by some writers never take place. The young patiently wait the time of their departure without ambition, and the old one views them without jealousy. Besides, the young queens remain entirely passive beside the mother queen, to whom alone belongs, during her life, the command of her empire.

In fact, the Abbe Rosier, and every man well informed in the culture of bees, say that young queens never lay in the domicile of their birth, during the life of the mother queen. They wait the departure of swarms, of which they take the command, and go to found some new establishment out of the dominion of the queen mother. Those who are so unfortunate as not to be chosen to lead a swarm, are at the end of summer massacred, in the same manner,

and at the same time, as the drones are; for bees will suffer only one chief to govern them.

When the swarming time is over, as there must be only one queen in each hive, the family will choose one of the young queens to succeed the old, if the latter has ceased to be capable to continue the population. Then the family itself, at the same time that it massacres the drones, destroys all the surplus queens, to save the expense of supporting them in their hive, during the following autumn and winter.

We need not be afraid that the queen elect will perish in the interval between autumn and spring; but if that event should happen, the family would still subsist, because the cells destined for the queens contain fecund eggs, which will hatch in spring, and that alone is sufficient to maintain harmony and order in the colony.

When the queen intends to lay, she chooses a cell suited to the egg which she has to deposite, and never makes a mistake. She creeps backward into the cell, where she deposites her egg at the very bottom, and immediately retires, and thus in succession as long as she can find empty cells, and has eggs to lay. The manner of the queen, creeping backwards into the cells to lay her eggs, is remarkable. So also is that of the drones, for the emission of the seminal fluid to fecundate the eggs. The drones are too large to introduce their whole body into the cell, but the facultative organ projects to the bottom and touches the egg.

During autumn and winter the queen subsists on honey; but this honey remains in her first stomach only till part of it is absorbed for her nourishment, and then passes into her second stomach, where it changes into wax, which, as soon as the change is complete, she disgorges by the mouth like other bees.

Bees are very much attached to the queen, and have a particular regard for her welfare, because the prosperity of the colony principally depends upon her fecundity. The more eggs she lays, the more numerous will be the neuters, or labourers, and the better will their works advance, which are carried on with admirable unity and harmony, by the pure instinct of the multitude, without the least solicitude on the part of the queen, except to supply the cells with eggs, as they are prepared to receive them.

The arbitrary will, the general and despotic command, over every thing which concerns the order, movements,

and domestic economy of the colony, which some authors impute to the queen, does not exist in nature. Each bee is engaged in the performance of that part of service for which it is fitted. The queen is appointed to lay wherever she can find cells to place her eggs. The drones are to fecundate the eggs when laid, and the neuters, or workers, are to construct combs and cells, where these eggs are to be deposited, and finally to fill the cells with honey, after the young bee shall have left them. All this is done by the instinct alone with which nature has endowed each of these insects.

M. Valmont de Bomare says: The mother bee is the soul of the hive. If she happen to die, all work ceases, and the bees suffer themselves to die of hunger. That their attachment for her is equal to her usefulness in the state. That the queen never uses her power, but for the happiness of her subjects. This philosopher does not relate all the horrors of a family of bees on the death of a queen.

The whole prosperity of the colony turns on the fecundity of the queen. The instant she dies, there is a general mourning in the hive. The bees abandon themselves to fury, and to all the excesses of the most complete anarchy. They pillage the honey, and tear the combs in pieces, if no embryo queen remain in the hive. But in the midst of this confusion, if another queen, or the embryo of another queen, taken in a piece of a comb from another hive, could be introduced among them, the mourning and anarchy would instantly cease, and the bees would resume their labours.

Our moderns pretend, that on the death of a queen, the bees can take a worm, which nature intended to form into a working bee, and make of it a new queen! This opinion is absurd, and violates the immutable laws of nature.

CHAPTER IV.

OF THE DRONES.

The drone is easily distinguished from the other bees. He is not so long as the queen, but is much larger; and when he goes out of, or returns into the hive, his flight is announced by a droning sound, from which he takes his name.

In the simple hive, we find from one hundred to four or five hundred drones, in proportion to the number of the neuters, or working bees; in the double hive, or hive of two stories, we find from eight to nine hundred; but in the pyramidal, or hive of three stories, we find from a thousand to eleven hundred, and always proportioned to the number of the neuters in the colony.

The construction of cells advances in proportion to the number of neuters or workers, and the laying of the queen in proportion to the number of cells; the number of drones should be in like proportion to fecundate the eggs.

The queen can lay four or five hundred eggs in less than a day, but the work of fecundation, by the drones, is infinitely more laborious, and for its execution, requires a greater number of this species. Thus nature, always wise and provident, regulates the number of drones by that of the neuters, that all the operations of the colony may go on with the utmost unanimity and harmony.

The drone has no offensive armour, like the neuters. At the place where the sting of the latter is placed, is found the orifice, or sheath, which encloses the facultative organ for fecundating the eggs.

As drones of different sizes have been found in the same hive, it has by some been alleged, that they were endowed with different faculties and functions. From careful observation, I have discovered, that there is no such difference, and the variety of size arises only from the difference in age, between those hatched early in spring and those hatched later.

Mr. Braw, an English observer, discovered, before I did, that the drones introduced their posterior extremities into the cells, where the queen had laid her eggs. That they there emitted a whitish fluid, thicker than honey, but without its sweetness. This philosopher adds, that all the eggs, bedewed with this fluid, were fecundated, and those which were not, were sterile.

There is a fact, which I have verified, and which every amateur may also verify, by enclosing swarms of bees in glass hives, or bottles of transparent glass. They may soon perceive the regular movements of the drones in the suite of the queen, fecundating the eggs which she has laid. This labour of the drones is easily observed, from six o'clock in the morning till noon.

If by chance a colony of bees should be deficient in the number of its drones, the fecundation of the eggs would not be complete, and the colony would not produce swarms. Pingeron advises to take some from a neighbouring swarm. They may be caught, passing out of the hive, without danger, because they have no sting. They may be put in paper cones, and in the evening, by breaking off the pike of the cone, and placing them at the entrance of the hive, the drones will creep in, and fecundate the whole of the eggs.

I had occasion to verify this observation successfully, on a swarm of bees which deserted their hive, came a long distance, and settled near my experimental apiary, in the month of October. I put them into a new box, and fed them with honey and oatmeal gruel, during the autumn and winter. When they came to me they had no drones, and the spring hatch produced none. Notwithstanding, by the end of May, the box was filled with comb, and I had good reason to expect a considerable deposite of eggs from the queen. I recollected the precept of Pingeron, which I literally followed, and obtained the most happy result. All the eggs were fecundated, and in the month of July, the hive produced a very strong swarm.

Drones are hatched in the spring. They are called forth by nature, to fecundate the eggs which are laid the year which gives them birth. The object of their mission accomplished, they all perish without exception, massacred and dragged out of the hive by the neuters.

These epochs, the *birth* and *massacre* of drones, whether the bees be wild or domesticated, take place in all countries and in all climates, at the moment when the queens are prepared to commence or terminate laying. This single trait in the character of bees, which distinguishes them so much from other flies, confutes the theory of modern philosophers, who have given tables of comparison and identity between insects, which essentially differ.

The drone perishes, because he would be a charge on the community, during autumn and winter. But he first fecundates eggs, which will hatch in the spring, and produce his successors. The drones eat much more than the neuters. Their provisions would not suffice them through the inclement season, if they had not the foresight to destroy and expel from their colony all insatiate, useless mouths.

During the life of the drones, if they go abroad to forage on flowers and plants, the substances which they collect,

are converted into honey in their first stomach, as in other bees; but they never deposite this honey in the common stock. It passes into the second stomach, where it becomes wax, as in the queen bee, and which they likewise disgorge by the mouth. They (the drones) consume a great deal of aliments, and as these are all converted into wax, in the second stomach, the materials for making combs and cells, never fail in the hive, during the six months of their existence.

I have destroyed thousands of drones, in their ingress and egress to and from the hive, for the purpose of examining their intestines. I have rarely found any honey, but particles of wax more or less elaborated.

The drones never go abroad but in good weather, between noon and five or six o'clock in the evening; and it is presumable, that when they are not abroad, they live at the expense of the community, on the common stock.

When a hive swarms, a certain number of drones accompany the new colony, in proportion to the number of neuters, for the purpose of fecundating the eggs which the young queen may lay, during the remainder of the season; but they must perish as their fathers did, as soon as they become a charge to the colony.

CHAPTER V.

OF THE SIMPLE HIVE.

The simple or common hive, is a box or pannier, containing a swarm of bees, as they are usually cultivated in the country. This hive will produce swarms for many succeeding years, and for this reason are held in high esteem by old plodding farmers, who know nothing more profitable than the produce of swarms. They therefore preserve this old hive as long as possible; but as soon as it is suspected of decay, it is condemned to *plunder, exile,* or *death,* the next succeeding autumn.

To destroy a family entirely, and dispose of all its produce, brimstone smoke is usually employed. The bees, suffocated by the vapour, immediately die. The larvæ will, soon after, perish also; but the eggs, which before they are hatched are not affected by the smoke, are melted

down with the combs and destroyed. The larvæ, however few, which remain in the combs, deteriorate the honey. And however few of the worms are metamorphosed into nymphs, all go to the press together, and the honey, mixed with their ordure, loses much of its good quality.

Some, instead of suffocating the bees with brimstone smoke, immerge the hives in water, which produces the same fatal effect. The bees are all killed; the larvæ share the same fate as in the preceding method; and the honey obtained is no better.

These two methods, practised by at least three-fourths of bee owners, are most prejudicial to their culture, and it is to be hoped the government will interdict the practice.

When we drive a swarm from one hive to another, it is for the purpose of obtaining the products of their labours, without destroying the bees; but as the larva cannot follow the bees, it is unfortunately destroyed.

The method which our country people use to drive bees, is, to reverse, or turn upside down, the full hive, and place an empty one over it; then, by gently striking the full hive on the sides, compel the queen and all her family to ascend into the empty hive. Another way is, if they have panniers or boxes with openings on the top, as mentioned in the plan of M. Lombard, to place an empty pannier on the top of the full one, as it stands, and with a match of wet linen rag, set on fire at the entrance of the full hive, oblige the bees below, to ascend into the empty box above.

The castration of a hive, appears at first view, the most advantageous mode of taking a part of the product of the bees, and allowing them to subsist on the other. But on cutting away part of the combs, the honey flows of what remains, and englues or bedaubs some of the bees, and these englue others. If the queen should happen to be of this number, she perishes; and if she perish, without leaving a young queen, or eggs fecundated to produce new queens, the whole colony will very soon be destroyed. Besides, the castration cannot be so well performed, but that a number of cells will be removed which contain larvæ or chrysalids, which occasions a loss to the future generation, in addition to the loss of bees by smearing with honey.

All these modes are practised in Europe, and they all show the imperfection of the culture and management of bees. There are even some *amateurs* who cannot be per-

suaded that there is any better way of obtaining honey and wax, than by suffocating, castrating, or driving the bees.

To avoid these losses, it is only necessary, as spring opens, to put an empty box or pannier under the simple hive. When the bees have filled the upper box with combs, and the cells with honey, they abandon it, and descend into the empty box below, to continue their labours. This is what I call the two-storied hive of M. De la Bourdonnaye. If, at the opening of the second spring, another box be put under this hive of two stories, they will form what I call the *pyramidal hive*, the upper box of which may be taken off and emptied every autumn. This method obviates all the inconveniences of suffocation, castration, or driving, heretofore in use; inasmuch as the whole colony is preserved, and the queen, the neuters, nymphs, worms, and eggs, remain sound and untouched, in the lower boxes.

The panniers for the simple hive, should be made of osiers, broom, or straw. They are light, and the best suited to receive swarms which have settled on trees, high off the ground. They should be made of different dimensions, proportioned to the volume of the swarm which they are to contain. The multiplication of colonies depends much on the panniers in which the swarms are put. Families of bees in a confined situation, in a simple hive, will produce swarms sooner, than those in boxes which are too large.

Success is more certain, by beginning with small boxes. In these the heat is more concentrated; and heat never fails to provoke emigration, in good weather. This observation ought to be remembered by those who wish to increase their colonies in the shortest time.

CHAPTER VI.

OF THE TWO-STORIED HIVE.

The two-storied hive is the invention of M. De la Bourdonnaye, late Proctor-general Syndic of the affairs of Bretagne. This illustrious agriculturist attended to every branch of rural economy. He was one of the principal founders of the Royal Society of Agriculture, in Bretagne,

and one of the best informed agronomists among its members.

M. De la Bourdonnaye had read, in the memoirs of the Academy of Sciences, the mode which is practised in Scotland. To prevent swarms coming off too late in the season, the Scotch set a box under the mother hive; the bees then continue to occupy it because there is room, and the swarms are retained till the succeeding spring.

This learned cultivator had also read with attention, in the memoirs of the Academy, of an event which took place in a swarm of bees belonging to the curate of Tilley, near Orleans. The swarm was put into a hive, and set on the top of an empty tierce, where it was forgotten. The open end of the box was set over an aperture in the head of the tierce. When the hive was filled with wax and honey, the bees descended into the tierce, and continued their labours. The tierce was filled with wax and honey in less than five years, and weighed about five hundred pounds, when the bees were destroyed to obtain their produce.

In the reports of the Academy, M. Duhamel, the secretary, has developed the practice and habit of bees, where they find a situation suited to their accommodation. M. De la Bourdonnaye, availing himself of the observations in these memoirs, thought, that by placing an empty box, with a hole on the top, under a full box, the bees would necessarily descend from the full into the empty one, and that afterwards, the upper box might be taken off without the least prejudice.

M. Bourdonnaye communicated his observations to the Society. He had hives made of straw, with flat tops, with a hole of from fifteen to eighteen lines in diameter, for the passage of the bees. These empty panniers were put under the full hives; and after the bees had completed their work above, they descended into the empty panniers below, and continued their labours as he had anticipated.

To this union of two boxes, placed one under the other, we give the name of the Scottish hive, because the Scotch thus dispose their hives in the latter part of the summer, to prevent late swarms, which cannot collect sufficient nourishment for the winter. But the Scotch put boxes without tops, under their hives, and on the return of spring, they remove the lower box, to facilitate the issue of swarms. But M. Bourdonnaye is chiefly indebted to the observa-

tions on the tierce of the curate of Tilley, for the invention of his flat-topped hive, with a hole in it for the passage of the bees.

This differs from the hive invented before the time of M. Bourdonnaye, and also from the improvement made since. It consists merely in putting an empty box under another, which contains a colony of bees of the last or preceding year.

This second box ought to have its top perfectly smooth, that the one on the top, containing the bees, may fit closely. On the top of the second box, a little towards the front part, should be a hole, from fifteen to eighteen lines in diameter, for a free communication between the stories or boxes. The upper box should be luted in such a manner, that there will be no ingress or egress, but through the lower box which stands on the bench.

The boxes should be made from ten to twelve inches in height, and about the same in diameter. The hive of two stories would then be from twenty to twenty-four inches high, and from ten to twelve inches wide.

Early in spring, this hive will send forth a swarm much superior to that from the simple hive. And *frequently*, however small the family may be, it will furnish a second swarm in the summer following. We ought not to require more; and even then, there would be danger in removing the upper box, as M. Bourdonnaye seemed to hope and expect. In fact, the harvest of the two-story hive, is not to be expected every year, nor every second year, though it may sometimes happen. It is only after the queen has laid her eggs in the lower box, and after the eggs in the upper one are all hatched, the larvæ and chrysalids have quit their nymphal robes, and the whole family have descended from the upper to the lower story, that you may remove the upper box, full of wax and honey, without bee, larva, or exuviæ.

M. Bourdonnaye thought this the best mode, hitherto known, of obtaining the products of bees, without destroying, smoking, driving, or castrating. But this harvest is not annual and periodical. This was the point to which this esteemed cultivator wished to arrive; but his Scottish hive could not attain the end: he approached, without gaining it. The troubles of the province on account of the expulsion of the Jesuits, the misunderstanding between

the parliament and a member* of the court, the revolutionary movements which followed, and his advanced age, —made him abandon his enterprise.

It was in this state of things, that M. Bourdonnaye charged me with the solution of his problem on the mode of raising bees, and of drawing from them an annual profit, without doing them the least injury. He put into my hands, the journal of his experiments. It was not until after years of attempts, more or less profitable, and researches, more or less troublesome, that I was convinced of the necessity of forgetting, for at least one year, his hive of two stories, formed from a simple hive of an ordinary family, under which an empty box had been placed.

Here our author inserts a repeated description of the Scottish hive, and its defects and uncertainty. Also, a long extract from the Corps of Observations of the Society of Agriculture, Commerce, and Arts, by the government of Bretagne, in the years 1757, '58, '59, and '60, which occupies the whole of the seventh chapter.

CHAPTER VIII.

OF THE PYRAMIDAL HIVE.

At the opening of the second spring, the Scottish hive changes its form and name. It ceases to be a hive of two boxes or stories: a third box being put under the two former; and then I call it the pyramidal hive, on account of its elevation. This hive may have thirty to thirty-six inches in height, and ten to twelve in diameter. The junction of the second and third pannier, must be luted for the same purpose as the luting of the first and second.

M. Bourdonnaye thought that the Scottish hive of two stories would be sufficient to secure an annual harvest. To try the experiment, he engaged all the members of the Society of Bretagne. For a series of years, they made fruitless attempts to obtain, annually, the harvest of a pannier full of wax and honey, without flies or larvæ; and at

* The Duke of Aiguillon.

the same time, avoid the danger of leaving the under pannier without a supply of provisions for the winter.

This is an occurrence which is not every year practicable, in northern climates, when the Scottish hive is formed only of a simple hive, with an ordinary swarm, under which an empty box is placed. The success of this experiment is not certain once in two or three years, unless a sufficient depth is given to the panniers of the Scottish hive, to afford room, and prevent the incumbrance of the multitude of bees, engaged in filling the last cells, which are emptied of nymphs, newly metamorphosed into bees.

It is therefore time and space, which were wanting in the plan of M. Bourdonnaye. This time and space are completely supplied by the pyramidal hive. A larger space was required than the two hives afford; seeing that the multiplication of bees occasions an incumbrance, after the couvain of the preceding summer, and that of the spring, are hatched and united.

All difficulties are removed by the addition of the third box. The middle box will be filled with combs in less than ten days, and as soon as the cells are formed, they are supplied with eggs, by the rapid and successive deposit of the queen.

The addition of the third box, affords more room for the bees, than they had in the Scottish hive. There is no more inconvenience or embarrassment; the whole colony moves regularly; each working bee arrives easily at its place, and the work advances with inconceivable promptitude. These insects are very laborious, and seldom relax their labours but for want of room.

The third pannier is also very useful to the bees, in the excessive heats and storms in the months of July and August. They can then be safe from the plundering attacks of birds, and the rapacity of hornets and wasps, who make war on them, when they are too much crowded to find room in the hive.

The pyramidal hive is composed of three panniers or boxes, placed one under the other, in the following order.

1st. The simple hive. We will suppose a swarm to come off on the 21st of June, 1827. This swarm passes the summer, autumn, and winter, in the simple hive, and will be nine months old on the 21st day of March, 1828.

2d. The Scottish hive. This is formed by placing a box or pannier, under the simple hive, on the 21st March,

1828. This hive will remain in the situation of a two-storied hive, for a whole year, from the 21st of March, 1828, to the 21st of March, 1829. In proportion as the population of the simple hive was abundant, and the season favourable, the Scottish hive will, in its year, send out one or two strong swarms. In the spring of 1829, this colony will be twenty-one months old: nine months a simple hive, and one year a Scottish hive.

3d. The pyramidal hive. This commences when the swarm is twenty-one months old, on the 21st March, 1829, by putting a third box under the Scottish hive.

These three panniers or boxes are luted at their junctures, in such manner, that they appear to form one single hive; and the bees can pass in and out only by a single opening on the bench. By means of the holes, from an inch and a quarter to an inch and a half diameter, on the tops of the under and middle boxes, there is a free communication for the bees from one box to another.

This colony will remain in this pyramidal or three-storied hive, from the 21st of March to the 21st of September of the same year: it will then be only twenty-seven months old. It will have furnished many swarms, as well in its grade of Scottish, as in that of the pyramidal hive. The swarms of the latter will be very considerable; they commonly weigh from twelve to twenty pounds, of sixteen ounces.

On or about the 21st of September, (sooner or later,) the neuters destroy the drones. Then the upper box may be removed, and it will be found full of wax and honey, without bee, chrysalis, larva, egg, or exuviæ of any kind. The honey will be the produce of the current year, for the bees have consumed that of the years preceding: nothing but the wax will be old, for the first made combs still remain.

When the upper box is removed at the time specified, the hive will cease to be pyramidal, and will be reduced to the Scottish, or a hive of two stories. It will remain the six months of autumn and spring, in this state of Scottish hive; but at the return of spring, a third pannier or box is added, and then it resumes the name of pyramidal. Thus, from year to year, in continued succession, in each spring, an empty box or pannier is put under the Scottish hive; and each autumn, a full one is taken off the pyramidal hive. It is an annual and periodical harvest, for which there is no dread of hail

or frost, and on this account, is more certain than that of our cereal plants, our vineyards, or meadows.

The pyramidal hive will not always require twenty-one months for its construction, nor twenty months, to produce a good harvest. There are circumstances when thirteen months will suffice to establish the hive, and sometimes even to take the harvest, as will be demonstrated in the following chapter.

We ought not to hesitate to add a third pannier to the Scottish hive, in the spring, even though the bees seem not to need it; inasmuch as they may not have constructed any combs in the lower story, and at the time you add the third, there may be two empty boxes below. These two panniers or boxes, will remain empty but a short time: the third will scarcely be placed, before the bees will descend from the first, into the second or middle story; and the room afforded in the lower story, relieves the colony from the encumbrance occasioned by a crowd, and which would prevent the bees from working so promptly and conveniently as is necessary.

Bees, in a pyramidal hive, never perish from want or cold. They are too *rich* to be *destitute of food*, and too *numerous* to feel the inconvenience of the most severe winters. When they are grouped together, they enjoy all the warmth necessary, and on the return of spring, the couvain is hatched nearly a month sooner than in other hives.

CHAPTER IX.

OF THE PYRAMIDAL HIVE IN FULL HARVEST AT THIRTEEN MONTHS OLD.

When a swarm comes off from a pyramidal hive, in May, June, or even before the 15th of July, in countries where the buck or black wheat is cultivated, the pannier or box in which the young colony is collected, is usually filled with combs in fifteen days; and all the cells are supplied with eggs by the queen, as soon as they are prepared. These eggs are regularly fecundated by the drones, and soon, an infinite number of worms may be observed, ready to be metamorphosed into nymphs; and these,

sloughing their robes, soon announce a new swarm. In this time, the bees are exclusively occupied in building cells and furnishing aliment, for the rising population, and collect no more provision than is necessary for the daily consumption.

If at this time (say fifteen or twenty days) a new box be placed under that which contains the colony, it will become a Scottish hive. The works will be very much advanced before the end of summer, and on the return of spring, the third pannier or box may be confidently placed, and then it will become a pyramidal hive. At the age of thirteen or fourteen months, or towards the latter part of September, on the usual massacre of the drones, this colony will be in full harvest.

This hive will therefore become Scottish at fifteen or twenty days old, and pyramidal in seven or eight months; and six months after that, in proportion as the season is favourable, about the end of September, the upper pannier or box may be removed, rich for harvest, perfectly filled with wax and honey, without bees, nymphs, larvæ, or couvain of any kind. The bees have all descended to the middle story, where the queen has finished her summer lay, which will not be hatched till the following spring.

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CHAPTER X.

OF SWARMS IN GENERAL.

When a hive becomes so crowded with bees, that there is not sufficient room for their accommodation, a colony emigrates, and makes an establishment somewhere else. This emigration, or swarming, never takes place unless it has a queen, duly qualified to direct and perpetuate the colony; and one alone is sufficient. Four or five days after a new queen has put off her nymphal robe, she is qualified to lay; and would lay, if she had a private establishment, separate from the maternal family, where she has no right to lay. She is then in a state to assume the direction of a swarm; which, when selected, will be disposed to follow her any where, and every where—such is the attachment of bees to their queen.

The first swarm from a hive, in spring, is generally from the last lay of the preceding year. This last lay remains in the hive during autumn and winter, in the state of eggs fecundated by the drones. These eggs do not hatch till the return of warm weather; and the drones hatched from this lay, as soon as they cast their nymphal robes, fecundate the eggs which the queen has already laid, in the new cells of the current year.

All the bees of the first hatch, are not destined to form a new colony. The maternal family reserves a sufficient number of young bees, to supply the place of those missing of the old stock, beginning with the drones, which are of the first utility. It often happens, that all the bees of the first hatch, are united to the maternal family. Then the first swarm which comes off, will be altogether from the spring lay, and will not take place till later in the season.

Attention ought to be paid, to hive a swarm as soon as possible after it appears, to avoid the trouble of stopping it on its flight, and the risk of losing it. A swarm rarely remains two hours on its first resting place, after it leaves its mother-hive; and if the rays of the sun beam severely on the place where it first settles, it will soon quit it, and seek a new asylum.

When the swarm is put into the hive, it ought not to be removed from the place till the next day, about the same time it came off, that the straggling bees may rally, and enter the hive, before it be removed to its destined fixture on the bench. When a new hived swarm is placed on its bench, if the bees which had not joined it before or during the night, should present themselves in open day, they would be treated as strangers, and destroyed. They would also be destroyed, if they return to the mother-hive, which they can never enter.

Straw panniers are the best to hive bees in. They should by rubbed inside with thyme, pennyroyal, or other aromatic plants, to attract the bees. The sticks of the pannier might also be rubbed with honey, and the bees would settle on them with eagerness. But people are not always supplied with panniers of sufficient capacity to contain a swarm, from a Scottish, or pyramidal hive. In such case, a second pannier should be placed under the first; and in a few days after, if it be found that the bees are not incommoded by their number in the upper pannier, the

under one may be removed. But on the contrary, if the bees be crowded in the single pannier, the second should remain: it is then a Scottish hive. These are not ordinary events, but they sometimes happen.

When a swarm of bees is housed, and the box or pannier placed on its bench, it should be well luted, leaving only one small opening for the passage of the bees. Cow-dung, with a fourth part of slacked lime, well mixed, is one of the best lutes which can be used. It will also be necessary to apply a very thin coat of the same composition, to all the seams of the hive, whether made of wood, straw, heath, or osier. It will become very hard when dried.

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If two swarms come off from two hives at the same time, and settle on the same branch of a tree, (which is not uncommon in a large establishment,) both the swarms ought to be put into one box or pannier. The family will be stronger by the union, and if, on the succeeding day, neither of the swarms renounce the association, and separate to form a new establishment elsewhere,—the union will be fixed and permanent, and the weaker of the two queens will be assassinated. But if three or four swarms settle together, it will be necessary to separate them.

This operation must be performed after sun down. On the cloth where the swarms are collected, two panniers must be placed, into which the bees must be divided as equally as possible, by dipping them up with a large spoon, the edge of which should be smooth so as not to wound them. If on the next day the bees appear tranquil, it is because there is at least one queen in each hive. If there should be two, the family know how to dispose of them: they only retain one, and that one, the best suited for the head of the colony.

In fact, if several queens happen to be in one hive, the neuters will permit only one to remain. They never mistake in their choice: it is always the strongest, healthiest, and most fecund, which is permitted to remain. Thus, the pretended combats, or duels between two queens, so emphatically asserted, and repeated by our modern knowing ones, have no existence, but in their own imaginations and books.

When a swarm leaves a hive, and the proprietor does not follow it, or cause it to be followed, it belongs to the first who finds and takes possession of it. But to secure

the swarms, and retain them in the apiary, it is only necessary to plant plenty of trees and shrubs around, and even to overshadow them, without obstructing their passage to and from their hives. When the bees swarm, they will be arrested by those trees and shrubs.

The pyramidal hives produce more numerous swarms than the simple or common hives. The more numerous the family, the more provision will be expended during winter; and the number of empty cells is in proportion to the consumption. The queen has more room for her lay, which is only limited by the number of cells, which she finds prepared for her eggs.

If, on the return of spring, the queen has only ten thousand empty cells, she will only lay ten thousand eggs, and the swarm from this lay will be moderate. If, on the contrary, she has fifteen thousand disposable cells, she will deposit fifteen thousand eggs, and the swarm from this lay will be very considerable. The fecundity of the queens is inconceivable. It seems that nature dispenses to them the faculty and care of laying, not in proportion to their physical means, but in proportion to the necessity and economy of leaving no cell without an egg.

From this observation, it may be concluded, that if it be advantageous to have hives sufficiently populous to consume, in winter, all the provisions of the Scottish hive, to increase the places for the eggs, and at the same time to advance the lay of the queen,—it is no less necessary, at the same epoch, to enlarge the room for this prodigious number to develop, before the swarm goes off. It was this necessity of enlarging the room, which led to the change from the Scottish to the pyramidal hive.

If, on the contrary, no extension of room be given to the population of the Scottish hive; if the individuals must remain compressed,—the consequent incumbrance would relax the labours in the interior, and, contrary to the intention of nature, would retard the descent from the first to the second pannier, as well as the departure of the swarm.

There are no signs, absolutely certain, to know when bees will swarm. The hives should be watched, in the swarming season, from eight o'clock in the morning, till six in the afternoon, especially in stormy weather. The greatest attention should be paid to the following signs:—1st. When drones are observed to fly about, in front of

the hive; their appearance announces a new people or family.

2d. When the bees are so numerous, that they cannot all find room in the hive.

3d. When, in the evening or night, a great buzzing is heard in the hive.

4th. The most unequivocal sign is, when the working bees or neuters, do not go abroad, in as great numbers as usual; and when they remain on the bench, charged with their load, without going into the hive.

Then a hot blaze of sunshine, succeeding a cloud, and a few drops of rain, occasions an insupportable heat in the hive, and the bees hasten to abandon it. Then the buzzing, which was great in the evening, and still increasing, is succeeded, for an instant, by a profound silence. In less than a minute, all the bees which are to compose the swarm, defile rapidly from the hive, and disperse in the air, where they are seen bounding like fleeces of snow. Sometimes the bees, when swarming, rise very high, especially if it be windy. They then, sometimes, rise out of sight. They may generally be arrested, by throwing sand or dust on them, or more certainly by throwing water, which sprinkles them like rain. A few discharges of a musket has the effect to make them fear an approaching storm. I have had occasion to try the two last methods with success.

When bees remain engrouped, or clustered to the bench, several days in succession, M. Ducarne de Blangis points out a method to determine their departure. He raised the hive three inches above the bench, and left it in that situation some days. The bees ceased to cluster. He afterwards, in a warm day, let the hive down suddenly on the bench. This produced such a sudden and excessive heat in the hive, that the swarm determined to abandon it.

There is another expedient, no less simple, used in the country. It is to place, in the night, young elder branches, with the leaves on, round the bench where the bees are grouped. The smell of the elder forces them into the hive; and the first warm day afterwards, the swarm, incommoded by the interior heat, abandon the hive and take their departure.

Swarms return to the panniers or hives whence they came out, if at the time of swarming they lose their queen. This sometimes happens, when a queen is too feeble to accompany her colony, and has strayed or perished. The

day following, a new queen takes place of the preceding, and the swarm hastens to depart, and abandons the mother country.

When any one can catch a queen at the entrance of the hive, he is sure to conduct the swarm to whatever place he pleases. I had a domestic, who seldom failed to surprise the queen at the moment of swarming. He watched for her at the entrance of the hive, on the bench, seized, and put her in the bottom of a pannier, which he had at his disposal, near him, and the whole swarm immediately settled in it.

This was the secret of M. Wildemann, who, in the presence of the London Society, made a swarm of bees follow him. He made it pass from one part of his body to another: if he changed the place of the mother bee, her faithful subjects soon followed her. Choleric bees (for this is a vice of their character) might make this a very serious sport. M. Wildemann has also taught us a prompt and easy way of changing bees from one hive to another. He carried a hive to a place which only admitted a dawn of light, and reversed it. The mother bee, whose nature is to be most vigilant for the safety and good of her state, presented herself in front; he seized her, and when he had her in custody, he was master of the whole colony. He put her into an empty hive, and all the bees followed. He took possession of the honey, drained it from the wax, put the couvain into the new hive, and placed it on the bench.

The Abbe Rosier informs us, that all swarms are not composed of fifteen or twenty thousand bees. There are some less considerable, some even have not more than three or four thousand. These are ordinarily the last, and are nothing better on that account. Besides, they come too late to have time enough to work and provide against the winter, or for the queen to lay to increase the number of her subjects. The first swarms are always best, because generally most numerous; but if not so numerous, the lay of the young queen would furnish a sufficient number to augment the population.

M. Rosier says, that the goodness of a swarm is estimated by the number of bees which compose it. As it would be difficult to count them, the better way would be to weigh the box before and after the bees are hived, and the difference would be the weight of the swarm. The best,

continues Rosier, are from five to six pounds. Those of eight pounds are very rare; and it is not desirable that they should weigh more, because so great a swarm is prejudicial to the mother hive, which, being deprived of so large a portion of its population, is in danger of perishing in winter.

This consideration of the Abbe Rosier, is not correct. The strength of swarms is proportioned to that of the mother hive. I have obtained swarms from pyramidal hives, weighing twelve, or even eighteen and twenty pounds; and so large, that it required two panniers to receive them—at once forming the Scottish hive, or the hive of two stories, of M. Bourdonnaye; and in the spring following, another pannier or box placed under it, will form the pyramidal hive.

* * * * * *

When the bees of a swarm are divided into clusters, the whole should be put into one hive, and there left to choose the queen which they desire to place at the head of the colony, and get rid of those who would be a charge to the state, which they would embroil by their continued divisions. The young queens which remain in the mother-hive, have no better fortune than those who had the ambition to pretend to the command of an emigrant colony: they will be put to death in like manner, as the supernumeraries which escaped.

CHAPTER XI.

OF LATE SWARMS.

Late swarms are those which come off in the latter part of summer, and have not time to collect a sufficient quantity of provisions for their subsistence during winter, and consume their whole stock as it is gathered. That food which bees of this kind collect, passes from the first into the second stomach, and is converted into wax. They could not subsist through the winter, unless supported by the proprietor.

Should these late swarms perish by cold or famine, their cells may be still used profitably, by keeping the pannier or box in a dry place, where it may remain uninjured till

the return of spring, when it may be used to put a new swarm in. The bees of this new swarm know how to employ these old cells; they will cleanse them, and the queen will supply them with eggs. (See Chap. XIV.) If a late swarm has been able, towards the end of the season, to construct cells from one to two-thirds of the capacity of the box, and the proprietor would feed them in winter, such swarm might, in spring, become the strongest in the establishment, from the number of cells which the queen would find to lay in, and which she would supply with eggs, on the first pleasant days.

A colony of bees frequently furnishes numerous swarms in the spring and summer. The two or three first, which come off in May,* June, or early in July, are the best, and generally succeed. Those which follow are rarely good, especially if they be very late. In that case, they ought to be returned to the hive whence they came, or be joined to a family of earlier swarms. This is an easy operation.

Such late swarms should be put into a box, prepared to form a Scottish hive. The hole in the top should be stopped with a piece of cloth. Towards the evening of the same day, this box containing the late swarm, should be placed under the box containing the family to which it is intended to be united; taking care to remove the cloth which intercepts the communication between the two boxes.

Through this communication, the late swarm will ascend and join the older swarm, in the upper box. This association does not occasion any loss, except of one of the queens. The one which appears, to the joint colony, the least capable of presiding over the labours, will in a day or two be found dead, outside of the hive. This manner of augmenting the colonies, and preserving the late swarms, is very easy and advantageous.

To judge correctly the value of swarms, they ought to be weighed, and the weight noted. The box or pannier should be first weighed, and after the bees are housed and settled, it should be weighed again: the difference is the weight of the swarm. This attention to the weight of the panniers or boxes, will be found very serviceable in winter,

* This was written for the latitude of Bretagne, in France. In the southern states of America, bees frequently swarm early in April, and sometimes in March.

to ascertain the gradual expenditure by the family, and to afford it timely aid, should it run short of provisions.

An early spring swarm, may produce a new swarm in the course of the summer; and the latter may be vigorous enough to amass a sufficiency of provisions for the winter. However, if it be a little too late in the season, it would be better to force them back into the hive whence they came, or to associate them with another swarm, than to keep them in a pannier which has not a supply of provisions for winter.

CHAPTER XII.

THE MANNER OF PROGRESSIVELY AUGMENTING A PYRAMIDAL HIVE.

The pyramidal hive, with the dimensions of ten, eleven, or twelve inches interior diameter, with a height to each, equal to its diameter, according to the number and strength of the family, which occupied the first pannier,—has in its combination, a height of thirty, thirty-three, or thirty-six inches.*

These dimensions in the hives ought to be regulated, not only by the number and the strength of the family occupying them, but also by the vegetable riches of the country, best suited to their subsistence.†

It is better to give a less, than greater extent to the box, which is for the first time put under the simple hive, to make it a Scottish. This observation is not to be neglected, if the family appears weakly populated. And when it is proposed to improve this into a pyramidal hive, the third box must not exceed the dimensions of the first.

This establishment once made, the periodical produce is, each year, one pannier or box full of wax and honey, without bees or couvain, regularly weighing from thirty-

* It will be observed in the sequel, that boxes of sixteen inches' diameter, are recommended.—*Translator.*

† M. Ducouëdic is perhaps too precise in these rules. He has said, that the whole secret of his theory is taken from nature, by a careful study of the habits of wild bees. The trees and rocks in France must differ very much from those in America, if their hollows and clefts be so nicely proportioned.—*Ib.*

five to forty-five pounds. The swarms which these hives produce, are of a strength proportioned to that of the mother-hive, and weigh from six to twelve pounds.

After the pyramidal hive has been established a couple of years, its volume or dimensions may be enlarged each returning spring, and by these means the product will augment from year to year.

The extent of combs and number of cells, increase in proportion to the enlargement of the hive.

The lay of the queen also increases in proportion to the number of cells, in which she can deposit her eggs.

The couvain becoming more numerous, the working bees increase, and consequently the interior works will be richer in wax and honey.

This method is simple, natural, and according to the physical increase of the colony, which augments in volume with time and space. It is easily understood, and every farmer can put it in practice.

To work advantageously, it will be sufficient, each returning spring, to give an inch, in diameter and height, to the new boxes, put under the Scottish hive to make it pyramidal.

Then in a few years, the interior diameter and altitude of the hives, will be equal to sixteen inches, for each box; and the increase of the population will be in the same ratio of progression.

Each box having attained the diameter of sixteen inches, and an equal height, the pyramidal hive will have in its interior, for working room, forty-eight inches elevation on sixteen diameter; and the boxes harvested each year, will contain from ninety to a hundred pounds. Such is the great product from bees, (by following this process,) in countries where perpetual spring prevails, and even in those where buckwheat and other flowering vegetables are cultivated.

The maximum of the interior height and diameter of one box, is sixteen inches, and the minimum, ten inches. An amateur indeed, might make experiments for his amusement, to enlarge his boxes beyond the maximum of sixteen inches. He would doubtless obtain much more honey, but rarely any swarms: because then the bees of each year would be kept by the mother colony, whose labours would increase, in proportion to the enlargement of the box, put under in the spring. This enlargement of the boxes, ought

to be made gradually, and never more than an inch per annum. This succession of gradation might proceed far; however, it must have some bound, which my researches have not enabled me to discover.

Panniers of straw, broom, or osier, ought to be used only to receive swarms. And to form the *Scottish*, and more particularly, the *pyramidal hive*, boxes made of pine plank, or other resinous wood, are best; and those made in the most simple manner, are excellent.

CHAPTER XIII.

OF THE PLACING AND REMOVING OF BOXES.

When it is proposed to change a simple hive into a Scottish—before sunrise or after sunset, the simple hive must be gently raised from the bench, which (bench) must be wiped clean with a cloth or sponge, and a square box with perfect joints must be placed on it, and on the top of this box must be set the simple hive, taking care that the pannier containing the bees be well adjusted to the box on which it is placed, and that all the rules mentioned, relative to the dimensions of boxes, and the strength of the colony, be strictly observed.

In the spring of the following year, to change this into a pyramidal hive, the pannier and box of the Scottish hive must be gently raised, without separating them. The bench must be cleaned, and on it an empty box placed, and on the top of that must be set the Scottish hive.

These three stages—the straw hive, and the two boxes, the first of which changed the simple hive into a Scottish, and the second, which changed the Scottish into a pyramidal hive,—ought to be perfectly united, and appear as if they formed only one single hive. Neither a bee, nor the smallest insect, should find a passage between the three stages: there should be but one small opening on the bench, for the ingress and egress of the bees.

When the upper story of a pyramidal hive is to be removed, great precaution must be observed, to prevent the derangement of the under boxes, and particularly not to disturb the bees. As soon as the uppermost box is re-

moved, the hole which served as a communication between it and the middle box, which is now become the upper box, must be immediately stopped with a wooden plug, covered with cloth. This plug must afterwards be covered with cement of plaster, or of lime and sand, to prevent the rain from penetrating the hive; and the whole should be covered again with a bonnet of straw, or some other material.

It requires three men to perform this operation. One holds the middle box fast, another takes off the upper one, and the third plugs the hole in the top of the box, which *was* in the middle, but *is now* on the top, to intercept, as promptly as possible, the passage by which the bees would come out.

The honey can be had fresh, at any time, when it is wanted to make comfits or liqueurs. By leaving the upper box in its place, as in that case the honey does not deteriorate or candy.

It sometimes happens, that the queen has not left the upper box, on account that the eggs are not all hatched. In that case, the box should be replaced, and the robbery deferred. This is a very rare occurrence. I never witnessed it but once.

CHAPTER XIV.

OF THE RE-ESTABLISHMENT OF HIVES, WHOSE POPULATION HAVE PERISHED, IN AUTUMN, WINTER, OR SPRING.

"When the birth of bees commences, more than a hundred may be seen coming out of their cells in one day. The hive populates rapidly, and in the space of a few weeks, the number of the bees become so great that there is scarcely room to contain them, and this produces that colony which is called a jet or swarm."

When M. Réaumur expressed himself thus, he was not far from the discovery of the re-establishment of hives, whose population had perished. One single reflection on the existence of the queen's eggs in the hive, and the promptitude with which these eggs hatch on the return of warm weather, would infallibly have led him to the discovery of the phenomenon. For the greatest discoveries in the mysteries and caprices of nature, we are oftener in-

debted to the whims and sports of accident, than to the meditations of the naturalist who is engaged in the search.

It has heretofore been a general custom, when bees are found dead in spring, whether from want of subsistence, the intemperature of the season, or from the pillage of foreign bees, to remove the box and melt down the combs for the sake of the wax. But it is now ascertained, that a greater advantage may be derived from these hives, the knowledge of which has hitherto escaped those who are the best informed and celebrated in the culture of these insects.

Couvain* exists in the cells of the waxen combs, thus melted down; and this couvain exists in the state of eggs, which have not perished with the bees. These eggs are almost imperceptible, glued to the bottom of the cells, just as the queen placed them. These eggs cannot hatch till the return of warm weather, and then they must necessarily hatch, if the combs which contain them be preserved, because it is the pledge and order of nature.

It is the couvain remaining in the state of eggs, fecundated, before the destruction of the drones the preceding year, which is to produce the first swarms in spring, if the family has not perished. It is also the couvain of the current year, which the queen has deposited in the cells, after the destruction of the drones, during the autumn, the last months of winter, and the first of spring, which can only be fecundated by the drones of the first swarm, when they shall be hatched and in activity.

In the month of June, 1812, I placed in the open air, and to a southern exposure, some hives, the families of which, being swarms of the year 1811, had perished; some for want of subsistence, or from the pillage of foreign bees; others from the intemperature of the spring, which did not permit the bees to collect sufficient for their daily provisions. The bees had all died before the month of May, and the boxes had been removed from the stalls.

Early in July, the couvain was in great part hatched, and promised good hives.

When I observed the couvain of these dead colonies to hatch, naturally, and in great quantity, at the return of warm weather, I thought it would be necessary to provide

* Couvain, in its most comprehensive sense, means the embryo, in every state, of eggs, worms, chrysalids, or nymphs.

for their subsistence, as there was no honey in the cells, nor bees to procure it. I thought it perhaps possible to re-establish these hives, which were believed to be entirely lost.

I forthwith gave honey to these nascent bees. I placed the honey on plates, covered with paper, pricked full of holes, with pins, that these young bees might not englue, or bedaub themselves, while pumping up this nourishment with their trunks or probosces. I was very soon convinced of the happiest results, from this method of hatching the couvain remaining in the combs, after the families had expired, and also from the manner of subsisting the nascent bees.

I only furnished seven plates of honey to each of these new families, one each day in succession, and the whole couvain (of the hives submitted to this proof) were entirely hatched, and sufficiently strong to fly abroad and gain their own subsistence without any other support.

I have repeated my experiments, and have constantly obtained the same results.

In the spring of every year, when it is rainy, a very considerable number of swarms perish, either from want of food, or the continuation of humidity, which produces dysentery more than any thing else, or by the pillage of foreign bees. The combs are then generally melted down, without any consideration for the couvain contained in them. The ignorance of the value of this couvain is the cause of great prejudice in the culture of bees.

When hives are thus and so frequently depopulated, the boxes should be removed from their stands and put in a dry place, secure from inimical insects, such as candle millers, spiders, moles, mice, &c. and wait for the fine days of summer.

On the arrival of hot weather, the boxes may be placed in the open air, in a southern exposure, in a place separate from the other bees. In a short time, the couvain will be observed to hatch, and we shall very soon have working bees, drones, and queens, and the hives will appear to renovate and experience a sort of resurrection. The observations which I have made, and the results obtained, leave no doubt of the value of this new discovery in the culture of bees.

While I was occupied in this sort of resurrection, in exposing the hives submitted to my experiments to the great-

est effect of the sun's heat, I did not let any more light into the interior of the boxes, than was necessary for the circulation of the air. I only left small apertures, at proper distances between the boxes and the stands, through which strange bees could not enter, nor the new born bees get out.

When the couvain is entirely hatched, and the colonies in full strength, the boxes may be replaced in their former position in the apiary, and the necessary openings made, for the egress of the young bees, whose instinct will lead them out to forage in the fields.

Each family, thus re-established, is a new swarm, and ought to succeed better than ordinary swarms; because it is supplied with waxen combs in perfection, and nothing remains to be done, but to supply with honey and couvain the cells which the mother colony had made before it perished.

Fifteen or twenty days after this sort of resurrection, if the weather be fine, and the bees appear to work with ardour, a second box may be placed under, and it will become Scottish, and in the spring following, it will be in a state to become pyramidal, and the upper box, or pannier, may be removed with its contents, in the autumn of the same year.

This hive will afterwards yield, annually, a harvest of a pannier, or box, full of wax and honey, without bees or couvain, besides one or more swarms.

I am convinced that the farmers would gain more than they would lose, if they would not destroy the combs of the bees which have perished, even in autumn or winter, but to use the boxes, with the combs in them, to receive other swarms, in spring or summer, either by putting them *under* or *over* other hives, according to circumstances, and the form of the hive, as I have already practised and before observed.

It is no longer to be doubted that couvain does exist in the combs of these hives, formed and fecundated before the destruction of the drones, and that it will naturally hatch on the return of warm weather.

Though all the couvain found in the cells be not fecundated, (which may be the case,) because some may have been laid after the destruction of the drones, yet these are worth preserving, because they will be fecundated by the drones of the hive to which they will be united.

The couvain of other insects as well as bees, hatches solely by the heat of the sun, without the assistance of the mother flies, particularly the couvain of wasps. These insects (wasps) all die every year, either from the first colds of winter, or from the want of sustenance in the autumn, because they have not the instinctive faculty to lay up stores in summer; but their couvain hatches in their nests on the return of warm weather.

The same result would take place with bees, who cannot live through the winter without honey. Should they die for want of food, or from any other contingence, their couvain would, like that of wasps, hatch at the end of spring, or at the beginning of summer.

If we wish to use the combs of a colony which died in autumn or winter, and whose work had not advanced so far as that the couvain could produce a complete stock, we should take a swarm in the second case of a Scottish hive, the hole in the top stopped with a rag.

As soon as the swarm is well settled in this Scottish case, that is, in the evening of the day in which it is housed, the rag must be removed from the hole, and the box containing the combs of the dead swarm placed on the top. The bees instantly ascend, take possession of the works, clean the parts which need cleansing, and the common queen immediately begins to lay in the cells which have no eggs, the drones fecundate those eggs which had not before been fecundated, and the old couvain is thus prepared to be hatched at the same time with the new.

From this moment this hive becomes Scottish by the junction of the two boxes, which will be soon filled with combs by the multitude of neuters. The queen mother, obedient to nature, will soon fill all the cells, old and new, with her couvain, which will be replaced with honey, if the season be favourable, before the end of summer; so that by the return of spring, this hive is in a state to become pyramidal, and to begin to furnish its annual harvest of one case in the second autumn of its establishment.

If the combs which we wish to make use of, be in a Scottish box, this box may be put under a full hive, whose bees are too rich or full fed. These bees are too lazy to swarm, and commonly die in their indolence. By placing this box under them, they will immediately descend and resume their activity.

The couvain remaining in the combs of the boxes thus

passed under, will soon hatch, the bees produced will join the old hive, whose population increases, and their labours become more active. It will assume all the qualities, and produce all the results, of a pyramidal hive, in periodical succession.

These observations deserve universal attention. The first, relating to the recovery of hives, whose population has perished, is a new discovery, and is a phenomenon, not less advantageous, than the discovery of the pyramidal hive. There is no danger of losing hives, though the active population of many of them perish by the ordinary causes of destruction, particularly among the simple hives, of the preceding spring. These families may be restored, on the return of warm weather, by the couvain left in the combs. Especially, if the boxes be used for the housing of new swarms: then the old couvain hatches with the new, and the population, thus increased, will become very considerable.

These hives, thus restored, may produce swarms the same year, especially in countries where buckwheat is cultivated, and these swarms can procure, for themselves, sufficient subsistence for the winter. However, if they should perish, their boxes will be valuable, to preserve for use in the following spring, to receive new swarms. Henceforward, pursuing this kind of culture, only a few individuals will be lost, while we profit by the fructifying the whole number of eggs remaining in the old cells.

The couvain is almost imperceptible in the cells, while they remain in the state of eggs, though they must have been there before the destruction of the drones, because they are fecundated; they remain, therefore, in the same state, during autumn and winter, and, in northern climates, even during the two first months of spring. This couvain cannot perish with the bees of the family; because, while in the egg state, it is impossible, until it encloses an embryo. But the sacrifice and loss is *certain*, by the inconsiderate and injudicious process of melting down the combs, which destroys every hope.

The secrets of nature do not always remain impenetrable; but she is niggardly, and only suffers a few of them to escape in an age. It is only in the age of *Napoleon le Grand*, that Messrs. Lavoisier, Mongolfier, Guiton, Morveau, Young de Vaux, Lacépède, Berthollet, Chaptal, &c.*

* *Etc.* I suppose, means Mons. Ducouëdic.—*Translator.*

owe the brilliant discoveries, in the arts and natural history, which excites the admiration of their cotemporaries, and will be the pleasure and felicity of posterity.

Honey is used in various kinds of cookery and pharmacy, and may be converted into sugar, and used in all kinds of confectionary. It is, moreover, an efficacious aliment, to produce vigorous and glowing health in children. For *that tender age*, its daily use would be much preferable to that of animal food, butter or cheese. It is also a valuable article in commerce, and, in France, it could be increased a hundred fold, by the great variety of forms under which it could be employed.

The wax of Bretagne is esteemed the best in Europe. It is pretended, that about a century ago, they bleached, in that province, six hundred and fifty thousand pounds of wax per annum, though the produce, at this day, does not amount to one fourth of that quantity.

When they obtained six hundred and fifty thousand pounds of wax in Bretagne, they ought to have collected, at least, two hundred and thirty-five thousand five hundred quintals of honey. The wax at one franc fifty centimes a pound, (about 28 cents,) and the honey at twenty-four francs the quintal, (about four dollars 46 cents,) would be an object of about six millions one hundred thousand francs, (equal to 1,184,600 dollars;) there are five departments in Bretagne, the average produce of each would be, annually, about one million two hundred and twenty thousand pounds, (226,920 dollars.)*

We have in the empire one hundred and thirty departments. No doubt all of them would not attain the height of these productions, but there are some of them would double it: and this branch of our rural economy could even be quintupled, in its products, in more than two-thirds of the departments, in the interior of the empire.

If people would consider then, what might be the importance of this branch of rural economy, in the interior, they would be astonished at the small portion of attention which it has attracted for some years past, and even to this day.

* Allow an average of the produce of Bretagne to the 130 departments, it would amount to the enormous annual sum of 158,600,000 francs, or, 29,499,600 dollars.

CHAPTER XV.

OF THE APIARY, OR PLACE WHERE BEES ARE KEPT.

In southern climates, the hives ought to be ranged on an eastern exposure. In northern climates, to the south and east, and never to the north, and much less to the west.

An apiary ought to be situated in a place somewhat retired; if possible, on a smooth lawn, overlooking a slope, at the bottom of which a limpid rivulet meanders through meadows. The hives, if not too numerous, and the ground will permit, should be ranged in line. But, if the ground do not admit of a long line, they may be ranged in two or more ranks, by preserving a sufficient distance between each line, that the bees may meet no obstacles in their flight from the doors of their hives, and that they may rise freely, without hitting the boxes of the range in front of their line.

Though the hives be numerous, it will not be necessary to separate them, that is, to make two or more establishments on the same domain. Bees know, and, occasionally, treat each other with respect. When they belong to the same apiary, they seldom plunder.

An apiary always ought to be neat. There should be no plants, nor herbs, touching the hives, on which inimical insects can harbour, or secrete themselves, to incommode, or prey upon the bees. It is not absolutely necessary, that it should be covered with a roof. It is sufficient, that each box be covered with a cap of straw, or an earthen vase inverted, to secure it from rain, or stagnant water.

Trees, planted round the apiary, are useful to stop the swarms as they come off. The pear, the apple, the cherry, and the peach trees, produce flowers much sought after by the bees, and swarms rarely fail to settle on their branches, when they come out of the mother hives.

To give the establishment an agreeable symmetry, the hives should be set about two feet apart, and a vase of flowers, or plants in which bees delight, placed in each space, such as thyme, savory, basil, and other aromatics.

The bench or stand ought, if possible, to be made of a single piece of wood, at least two inches thick, and sufficiently broad, to receive a box eighteen inches square. It ought to be at least six inches longer than it is broad, and to project that difference in front of the hive, as a resting place

for the bees, going and coming from and to the hive. A small gutter should be made, about two and a half inches broad, and a little more than half an inch deep, chamfered at the sides, leading from the centre of the hive, with a gentle slope to the edge of the bench in front of the hive. This will serve as a passage for the bees, in and out of the hive, and facilitate the draining of water from the hive, each morning at dawn, particularly in summer, for the warmth of the multitude produces, in the night, humid vapours, which descend in drops of water on the bench.

The surface of the bench ought to be a little convex, sloping each way from the centre, then the water could not collect on the plank, nor stop in the centre, but would flow out.*

The bench or stand should have four legs, or supports, about eight or ten inches long,† securely fixed. It is essential, that all the parts of the bench should be of equal durability, that no derangement may occur, till the whole be removed, when no longer serviceable.

There are some grounds where ants are very troublesome to bees; and whatever attention may be paid, there will always be some of them, which will endeavour to get into the hive, or establish themselves under its straw cap. In such case it would be convenient and advisable, to put under each leg of the bench, a small vase of hard-burnt earthenware, filled with water, in which the ants would drown in attempting to get on the bench.

In winter, great care should be taken to close up the entrance, so as to admit but one bee to pass at a time.

It is necessary to clean the stand, at least, four times a year, with a cloth or sponge, moistened with pure water, or salt and water, or rather with thyme or other aromatic plants. The hives must be raised gently, without separating the boxes. It will require two men to support a hive, and a third to clean the stand.

Stands ought to be prepared, and always in readiness, in summer, to receive hives, which ought to be placed on them in the evening, or the morrow morning, of the day in which the swarms are housed. The stands should be rubbed with thyme, or some other aromatic plants.

* This is hardly reconcilable with the preceding direction, and the use of the gutter.—*Translator.*

† See Chap. xix.

Bees require water, and, when too far distant, they may be supplied by means of shallow vessels, filled with water, which can be renewed from time to time. If some cresses were put into the vessels, they would grow and flourish. On these the bees could find support, going down to the water, which they could pump without the least danger; and the proprietor could in this manner, procure a very wholesome salad, which he could dispose of at pleasure, still leaving the roots of the plant growing.

It has been remarked, that the product of bees was never so abundant in covered apiaries, as in open air.

Mr. Chambon observes, that it is essential that the apiary should not be embarrassed by herbs growing as high or higher than the stands, because the bees which are loaded and fatigued, and those also which are enfeebled with cold, are arrested by the herbs, and have a great deal of trouble to regain their habitation. If they hit those herbs in passing, they fall, and cannot easily recover themselves.

This observation (of Mr. Chambon) is not very correct. It would be still better, not to have any herbs in front of the hives. It is a retreat for wasps, and other insects, inimical to bees. It requires a smooth place, often swept, and which does not hold the rain water. In front of each hive, a little board should be placed, sloping gently towards the ground. On this the weary bees could stop to take breath, and easily regain their habitation.

The vicinity of cities, is not favourable for a bee establishment, on account of the swallows which flock thither in spring, and destroy a great many bees. A still worse situation is the vicinity of forges and manufactories, which require a great deal of fire, and emit a great deal of smoke. The open country, and the vicinage of forest trees, are the best situations for hives.

A southern exposure, in southern countries, if the apiary be not covered and shaded by fruit trees, is often dangerous to the bees, because the combs may melt, by the excessive heat, and the honey flow out: this, however, could be remedied by covering the hives with booths of branches, to secure them from the heat.

In front of the apiary, there may be a plat of thyme, and all the other aromatic herbs in which bees delight, on a slight elevation, so as not to impede the bees in their movements. The old bees would rest there on their return from the fields, and the young, before risking long voyages, would

exercise their strength and industry on these balsamic plants.*

CHAPTER XVI.

ON HONEY, POLLEN, WAX, AND PROPOLIS.

Sect. 1. Honey is a gummo-saccharine, fermentable substance, and is the immediate principle of all vegetables *without exception.* This alimentary substance seems destined to nourish *all plants*, particularly *in their infancy*, as milk is destined to nourish all viviparous animals. It is found in all flowers, but principally in simple flowers. Its presence is also, afterwards, perceived in all fruits. It manifests itself in the herbs of our meadows, the ears of grain in our fields, and in the leaves of all trees. It is also in the roots, as well as the body, and even to the top of all vegetables. It exudes from the trunks of trees. It seems to be the *soul*, and is, in fact, the vital principle of all plants without exception. In losing this substance, all plants in general decay. It is the (term) *end* of their existence. The food of man is impregnated with this fluid, and bees know how to find it every where. But as yet it is only a gummo-saccharine substance, and must pass into the stomach of the bee to become honey. As the productions of nature are infinitely variegated, so honey, in its consistence, taste, and colour, varies according to the productions of every country.

Bees extract their honey generally from the flowers, leaves, fruits, and bodies of trees and plants.

The honey, extracted from flowers, is the nectar, which they enclose, so much boasted of by the ancients, who made of it the celestial drink of their gods, and to which they gave the name of ambrosia.† For this principle of honey, we are indebted to the circulation of the sap in spring.

* These plats, of simple and aromatic shrubs and plants, produce other precious advantages: the honey derives from them an odorous and balsamic perfume. The plat ought to be at least four feet distant from the hives.

† Was not the ambrosia of the ancients, the food of their gods, the sugar of honey? The *nectar* was undoubtedly *hydromel;* and *ambrosia, comfets or preserves,* made with honey.—*Translator.*

Honey extracted from the leaves, is that which in the country is properly called honey-dew, *(miellee.)* This is produced by the transudation of the juices of plants and trees, through their leaves, in greater or less quantity, according to the species. This honey-dew nature dispenses more particularly and profusely in the two first months of spring and summer, that is to say, on the renewal of the sap in those two seasons.

The honey extracted from the bodies of trees and plants, through the bark, is principally derived from the juices of the second sap, which a kind of bugs, or vine fretters, (pucerons,) pump out, for the benefit not only of bees, but of a thousand other kinds of insects, by almost immediately ejecting what they suck out.

There are other insects, worse than the vine fretters, (pucerons,) for these never injure the trees in extracting their sap, such as hornets and wasps, which tear the bark off trees, to construct their combs and cells, from the wounds thus made, exudes a juice, from which bees derive a profit.

Bees are also fond of the juice of fruits, which they eagerly seek after, whenever the hornets, wasps, earwigs, or birds, have broken the skin. The humble raspberry, and the superb wild cherry tree (the acacia of Europe) offer also, in their fruits, a rich vintage for bees.

These juices, at the time of extraction, are not properly called honey; but they soon become so, by their prompt fermentation in the first stomach of the bee.

The observations of M. Boisier de Sauvage, of the Royal Society of Sciences, at Montpelier, read at the sitting of the 16th December, 1762, on this important subject, are most exactly true. They absolutely develop the knowledge, previously unknown, of what the essence consisted, and the extent of its presence, in all classes of vegetables. I have, for many years, made it my particular study, to pursue and verify these observations on the origin of honey; and, in my observations, I have found them minutely exact, and strictly true. I have considered it my duty to communicate these sage observations of M. Boisier de Sauvage, in the next chapter.

But the collection of honey, by bees, of which M. Valmont de Bromare has given the *history, deserves equally to be known.* The opinion of *Linnæus, reported by this sage,* approaches very near to the discovery of M. Boisier de Sauvage, on the subject of the origin of honey.

M. Valmont de Bomare remarks, that Linnæus observed, more correctly than any before him, that flowers had at the bottom of their calices, some species of glands, full of mellifluent liquid. That it was from these nectariferous glands the bees delight to draw the honey, which fashions in their stomach. It was formerly believed that honey was a dew which fell from heaven,—nobody believes so now,—it is known, on the contrary, that dew and rain are most prejudicial to honey. Bees have always known these glands, which our modern botanists have lately discovered, and, in them, they have always sought and found their honey; but sometimes they find this liquid *effused* on the leaves.

An attentive observer, continues M. Bomare, following Linnæus, might, in spring, see trees, the maple (erable) among others, whose leaves are all covered with a species of honey, or sugar, which makes them shine, and if one of these leaves be placed on the tongue, the honey taste will soon be recognised. Whether that liquid remains in the glands, or out of the glands, it is the primitive material of honey. It is that which the bee seeks after, and amasses, to compose aliment, proper for the nourishment of itself and companions. Here is the system of M. Boisier Sauvage *announced*, but not so extensively *developed*, by Linnæus.

ON POLLEN.

Sect. 2. Pollen is a substance, extracted from the stamina of flowers, which the bees collect in dust, or small grains, which they bring home in little pellets, fixed to the hinder parts of their thighs. This is a surplus booty, for they have their stomachs filled with the juices of the same flowers which they pumped out with their trunks, and stowed away in their first stomach, first for their own nourishment, and afterwards to be rendered by the mouth in the state of honey, in the hive, for the employment and nourishment of the interior workers.

In summer, bees are continually seen loaded with pollen, bringing it to the hive, in its natural state. As has just been observed, it is only a surplus booty of the boldest working bees *without*, and with which those *within*, accommodate themselves for nourishment. This pollen, which these home workers consume, becomes also honey, wax, or propolis, according as the want of the different materials requires.

Pollen is, therefore, a portion of what is properly called the nourishment of bees, and one of the principles of honey, wax, and propolis. But that substance is never applied to *that kind of use*, given to it by M. Lombard, sect. 5. of the first part of his manual.

The grains of the pollen, says M. Lombard, are filled with an oily substance. They serve as nourishment for the bees in the cradle, (au berceau.) Thus bees are continually seen bringing it home, on their hind legs, during the flowering season, which is the grand lay of their queen.

The nourishment of bees in the cradle.—This is an inaccurate expression. Bees have no need of any nourishment in the cradle. The eggs, to which they owe their existence, are, after fecundation, enclosed in their cells by pellicles of wax. From these eggs are produced, at first, worms, which without the waxen pellicles being broken, live in the cells, and there envelop themselves in silken robes, which they begin to spin the moment they come out of the eggs, as do all other insects of the family of bees, and chrysalids. The silken robes completed, the worms are already metamorphosed into nymphs. They remain still enveloped until they change again, in form and nature. They finally become bees. They then burst their cerements, strip off their nymphal robes, abandon their cradles, join the other bees, and, if the weather permit, fly to the fields, but if the weather be unfavourable, they live on honey, like the others.

But, *in its cradle*, the bee has eaten nothing: *it could eat nothing*, because it was in a sort of prison—like a chicken in the egg-shell. Thus we see the interior workers relieved from great embarrassments, *gratuitously* imposed on them, *pap-feeders* to the worms, and afterwards to the nymphs, sometimes exceeding in number fifty thousand.

Finally, this pollen, which our *manual and complete treatise makers* would have to be wild wax, is nothing but a saccharine substance, brought in its native state to the hive, by a certain number of the most avaricious neuters, who, not satisfied with filling their stomachs, but also load the triangular pellets of their thighs with pollen. This pretended wild wax does not exist in nature, and the pollen, truly, is nothing but a balsamic substance, convertible into honey. I even believe, that this substance, before changing its nature, may be a feast for the interior bees, who generally live on honey, or even a balsamic remedy, necessary to preserve health in the interior of the hive, and finally, that it is only on these two accounts that pollen ought to be considered.

Having treated of the manner in which bees collect honey and pollen, and of the nature of these two balsamic substances, it behooves me to show the best manner of proceeding to derive the greatest advantages from them. The combs must be taken out of the boxes, and placed so as to drip into large vases. Care should be taken to separate the combs of the same box into two lots: the whitest yields the most beautiful honey; that is to say, the *virgin honey*, or *mother drop*.

When the combs have dripped sufficiently, they must be passed to the press, to force out the remaining honey. These two qualities of honey should not be mixed in the same cask. The virgin honey is infinitely better than that which is obtained by expression.

Rosier says, that the ancients, who knew nothing about sugar, used a great deal of honey in their cookery. They mixed it, also, if we may believe Virgil, with rough and hard wine, to correct its bad quality. *That custom is still preserved in many countries.* Some regard it as a universal remedy, or panacea, and believe it a preserver from corruption, and a prolonger of life. Pythagoras and Democritus took no other aliment than bread and honey, in the persuasion that this nourishment would prolong their days. Pollio, having arrived at an extreme and happy old age, being asked by Augustus, by what secret he had attained to such an age, without infirmities, answered, that his secret was *honey*, on which he had subsisted.

This substance was in such great veneration at that time, that it was regarded as a sacred food. The ancients also called it the *gift of the gods,—a heavenly dew,—an emanation from the stars.* At present we do not hold its origin in so high respect; and the use of sugar, which has succeeded it, has banished honey from pharmacy and the apothecaries' shops. The poor country people still use and make delicious refections of it, and also salutary and agreeable beverages.

French physicians pretend that honey *warms* and *desiccates* in whatever form it is used; whether as aliment or seasonings. Phlegmatic temperaments, and those who by sickness or otherwise abound in gross or viscous humours, cannot safely use it; and physicians do not prescribe it, except in diet drink, gargles, and injections. But, in surgery, it is used with success in lotions, to wash and deterge ulcers. Honey is the surest and most efficacious of all remedies against the sting of bees.

ON WAX.

SECT. 3.—Wax is a gummo-balsamic substance, formed from parts of honey which the bees pass from their first to their second stomach when wax becomes necessary for their works. The conversion of honey into wax is effected by a longer cooking or digestion of the saccharine substances, which the bees receive into their first stomach for their nourishment, and which by a momentary trituration becomes honey. When the honey passes from the first into the second stomach, it changes its nature and becomes wax.

"In the months of April and May, bees collect the materials of wax, from morning till night. But when the weather grows warmer, they make their principal collections in the morning, because then the powders of the stamina, moistened by the dew of the night, are better prepared to incorporate together, and to be united in one mass. These powders, thus united, which form crude wax, differ essentially from the true wax, which softens under the finger, becomes flexible as pastry, and ductile; whereas the crude wax does *not soften* under the finger, is susceptible of no ductility, and is friable. Some easy experiments demonstrate, that the dust, powder, or farina of flowers, is the principal of wax," &c.

In these words, Valmont de Bomare, gives the opinion of Réaumur, and of other sages, who preceded that academician, and which opinion Messrs. Lombard, Bosc, Février, and others, have embraced, without knowing the cause, and without having examined the correctness of its merits. *There is no crude or wild wax.* The waxen material, properly so called, has never yet been discovered.

I considered it of importance to ascertain the fact, unbiassed by its plausibility, although presented by the most celebrated amateurs, who have preceded me in the culture of bees. I destroyed many swarms at the very season when bees return in the greatest numbers, loaded with those pellets which are observed on their thighs, and I never discovered any part of it laid up in any cell for their own nourishment, or for that of their couvain, *which, by the by, never eat.* These substances are consumed as soon as they arrive at the hive. They are, purely and simply, the materials of honey in the state of nature, which the bees bring home after they have glutted themselves, and on which the

queen, the drones, and domestic neuters feast, the moment this kind of provision is presented to them.

I have collected some of these pellets, which dropped from the thighs of the bees on the stand, at the entrance of the hive. I collected them in cones of paper, like sugar plums. I have tasted and eaten them, and found nothing but sugar extracted from flowers, and its aroma was nothing like that of wax.

Réaumur, one of our luminaries in natural history, led astray by this opinion of *crude* or *wild* (brute) *wax*, thought it could be gathered from flowers and plants. He was engaged in the experiment a long time, without obtaining any favourable result. This celebrated sage avowed his defeat, and acknowledged that no one ought to expect *real wax* but from the labour of bees.

During autumn and winter, bees, who live only on honey, can discharge nothing but wax. In that season, the honey, after having nourished the bee, uniformly passes from the first to the second stomach. If they were fed with sugar or vegetable sirups, they would produce honey with which they could supply some of their cells; but in general these insects make nothing but wax in autumn and winter.

Wax is necessary for bees in winter, for the construction of combs and cells, which will become the cradles of new couvain. They advance their constructions to receive the lay of the queen, which commences in the month of February, and earlier if the weather permits.

It would, therefore, be erroneous to believe, that bees never make wax-work only when they are forced to it, to furnish cells for the deposit of the queen's eggs, or to build magazines in summer, for their provisions. Nature has made them provident, and they are occupied in winter in these waxen works, which will be necessary for them on the return of summer. The construction of their cells in winter, advances in proportion to the consumption of honey. This is a fact which every body can verify. I have often made the experiment, about the end of October, to put families of bees into boxes, without combs or honey, and in the month of March, to find these boxes filled from top to bottom with combs. Because they were never left without honey, and with honey they could make nothing but wax. That kind of dust which is observed on many of our smooth skinned fruits, such as the prune, grape, &c. and which is called the flower of fruit, is not wax, nor can it become so

till the bees have gathered it, and convereted it, first into honey, and then into wax, in their own way.

The wax produced by these insects, is originally white, and notwithstanding we take it from the hives more or less yellow, and sometimes as black as soot, when very old—it may, by art, be restored to its original colour. But it is evident that there is some which will become whiter than others. Those furnished by the departments of Bretagne, and particularly those of Rennes, pass for the best in Europe.

Every experienced person knows, that honey combs are lighter the first year of their construction, than they are the second. That is to say, the wax produced by a box full of combs, in its first year, has never the same weight as the wax which is taken from a box, of the same volume, at two years old. The reason is plain. The bees each year cover their combs with new pellicles of wax, when they have no more room to build new combs; so that the weight of the wax augments every year.

Bees empty the cells of honey, which they consume in winter, and as they render nothing but wax, (the residuum of the honey thus consumed,) this wax is employed to repair and fortify the combs and cells. In winter, the bees always produce wax or propolis, from the honey on which they feed.

"I have seen," says M. Duchet, "some bees, whose houses have been deranged, renew, repair, or solder, by ligatures of new wax, that which had been detached—and this in autumn, winter, and spring, without going out. It is a fact," continues the same author, "which I have seen many times."

I have witnessed the same occurrences as stated by M. Duchet.

Swammerdam says, that bees have been observed to carry into their hives, genuine wax. They pillaged it from other hives, cut it into small morsels with their teeth, and applied it to the pellets on their posterior thighs. This may be, but Réaumur says, he never observed that particularity; and M. Chambon opposes the fact, in his learned notes at the end of Madam Chambon's manual.

I dare not permit myself to decide between these two learned and celebrated amateurs. I have never seen bees carry away wax from any hive; but here is a positive fact, respecting a broken comb, which took place in my own

apiary, in the winter of 1806. A comb without honey, was detached; it was cut up by the bees into little morsels, as minced and rounded as the finest sand. Insensibly this hashed wax disappeared from the bench, without its being perceived to have been taken out of the hive. And I am well convinced that the bees of the family, had put the small waxen morsels of the broken comb to a new use, that is, to the continuation of the construction of their cells, which they continued to build during the whole winter, from the top to the bottom of the box. These events are not rare, but are not attended to; because among the amateurs of the culture of bees, there are but few observers.

ON PROPOLIS.

Sect. 4.—When a swarm of bees is established in a hive, says M. Valmont de Bomare, their first occupation is to stop all the little holes and chinks which they find in it, with a material which is glutinous, tenacious, soft at first, but afterwards grows hard. This is called propolis. It is believed that bees collect this propolis from poplars, pines, willows, &c. However, M. Réaumur, that indefatigable observer, has not been able to discover them in that employment: and he saw bees using propolis, in countries where none of those kinds of trees grew. *It is a discovery to be made*, continues M. Bomare. However that may be, propolis is a resin, dissoluble in spirits of wine, and oil of turpentine. It is not always the same in consistence, odour, or colour. When it is warmed, it commonly emits an aromatic odour: some of it deserves a place in the rank of perfumes. Propolis is of a reddish brown on the outside, and yellowish within. Besides the use which is made of it in medicine, as a digestive, some experiments have convinced M. Réaumur, that, dissolved in spirits of wine or oil of turpentine, it might be substituted for the varnish which is used to give a golden colour to silver, or to thin plates of steel. If, for example, it was incorporated with mastic or sandarack, it would be very good to make gilt leather.

The discovery to be made, proposed by M. Bomare, *is already made!* after reiterated experiments made on bees, during their first labours in panniers, where they were but just housed. In dissecting numbers of these bees, en-

gaged in stopping the chinks in their new hives, nothing was found in their second stomach but soft wax, having already taken, or about to take, the aroma and consistence of propolis.

Propolis is therefore a third substance, gummo-aromatic, which forms in the second stomach of the bee. This propolis is produced from the wax itself. When the insect, for a special purpose, wants a cement more solid and firm than wax, it retains the wax, formed of honey, a longer time in its second stomach. A longer cookery, or continued elaboration, converts this wax into a new substance, which is distinguished by the name of propolis.

The ancients distinguished three kinds of propolis. Pliny the younger mentions it in long detail. But at present it is thought that there is but one sort of propolis. Bees use this substance to overlay the interior of their hives, and to stop all the little openings which would be incommodious, particularly in winter, by the penetrating winds which might intrude within their panniers or boxes. With this also they envelop the carcases of intrusive animals, which, after they have stung to death, they cannot remove from the hive. These, when embalmed in propolis, can emit no offensive odour.

Independently of the propolis, bees furnish also another substance, which the ancients called Erythacé. It serves to cement the combs together: Varro and Columella thought it better than propolis, for this use. It is less resinous than the latter, and much less fragile than wax, says M. N. Chambon, to whom it appeared to be a combination of the two substances. It is found in pretty large quantities, in the upper borders of the combs. Varro and Columella attribute to it the property of powerfully attracting bees. The *illusory pretension* has been somewhere advanced, continues M. Chambon, that bees can be attracted to a hive rubbed with a certain substance.

I take no part in the opinion of M. Chambon. The *pretension* to determine or induce bees to settle in a hive which contains some substance which they love, *is no illusion.* Almost every summer, and sometimes in the spring, foreign swarms come to me, and lodge with mine, even with swarms of the same year, and in simple hives. I attribute this alliance which they seek, to the custom I have, of never receiving swarms, but in panniers or boxes where there are combs of the preceding year, and where the fa-

milies have died for want of subsistence. I provide myself with these panniers, at the merchants', who buy them to melt the wax. If it be not to the old combs of these hives, that I owe the arrival of the foreign bees, the true motive is unknown to me, and this phenomenon is to be imputed to some other physical cause, not yet discovered.

Furthermore, this substance, called by the ancients Erithacé, would not be collected by bees in a state of nature, and can only be propolis in a state of perfection, of which we know nothing of the process, that is to say, the manner in which it is elaborated in the second stomach of the insect, or the manner in which it is wrought when it is used.

CHAPTER XVII.

OBSERVATIONS ON THE ORIGIN OF HONEY, BY M. BOISSIER DE SAUVAGE, OF THE ROYAL SOCIETY OF SCIENCES, OF MONTPELLIER.

To explain the origin of honey, it is sufficient to develop and explain a vegetable salt, sweet and saccharine, which is the base or principal material, and appears in a form, either fluid, or viscous, or in little drops.

In fact, this vegetable salt, or mellifluous essence, or honey dew, is generally the only substance which bees collect to make their honey. And *it does not appear* that they do any thing more than to collect the parcels from different sources, and put them up in store in their cells. Time alone brings this material to perfection, and gives it the requisite consistence.*

The part of flowers which botanists call the nectarium, or nectarine cup, is the reservoir best known, whither bees resort to pump out a liquor, which, in its base, is the same as the *mellifluous essence,* or *honey dew.* But after the flowers, or at least a great part of them, have faded, the *mellifluous essence,* properly so called, furnishes to these industrious insects an abundant harvest, which sometimes exceeds their wants and avidity.

I have observed two sorts of mellifluous essence, which,

* Time alone could not give this matter the requisite consistence, if it had not been elaborated in the first stomach of the bee, and afterward disgorged in the state of honey.—*Author.*

however, appear of the same nature, and with which honey bees equally accommodate themselves. It will be seen by the sequel, that both derive their source from vegetables, though in a very different fashion.

The first sort, which is the only one known to agriculturists, passes for a sort of dew, which falls on trees, and is, however, nothing more than a transudation, or sensible transpiration of the sweet and melliferous juice, which, after having circulated with the sap, in different parts of certain vegetables, separates from it, and comes out in a state of preparation, either in the bottom of flowers, or on the upper parts of leaves. This is what is called mellifluous essence, or honey dew, and which rises in some plants in the greatest abundance, sometimes in the medullary or pithy stalk, as in sugar cane, and Indian corn or maize; sometimes in the pulp of fleshy fruits, which, in their maturity, have more or less of sweet savour, according as the melliferous juice is more or less confined, or developed by other principles.

Such is the origin of the manna of the *ash trees* (frânes) and maples (érables) of Calabria and Briançon, which flows abundantly, when it is fluid, from the leaves and trunks of these trees, and assumes, when expissating, the concrete form, under which it is commonly employed.

I had for a long time conjectured, that the melliferous essence or honey dew, spread on the leaves of these trees, was nothing but a *transpiration*, although the form of drops did not much resemble it, but was more like a species of rain. On a close examination of some of these *honey-bearing* trees, I by chance met, on a live oak, some of this recent honey-dew, in its primitive form, which was that of transpired moisture. The leaves were covered with many thousands of globules, or minute drops, rounded and close set, without touching, however, or mixing—very much as may be seen on plants, after a long and thick fog. The position of each globule, seemed already to indicate, not only the point whence it exuded,* but also the number of the pores or glands of the leaf, in which this honey-juice had been prepared. I satisfied myself that this had all the colour of honey, and that alone was sufficient to decide its

* This discovery explains very fully, the particular cause of the superiority of the products of bees in the vicinity of woodlands and forests. They there always find a rich booty of *honey-dew*, particularly on the renewal of the sap and vegetation in the month of August.—*French Editor*.

origin, without however removing the doubts opposed to it, by a contrary prejudice.

The honey-dew of a neighbouring bramble (ronce) was very different; the small globules having doubtless flowed or joined one to the other, either by the humidity of the air, which might have softened them, or by the heat expanding them, they formed large drops or tears, and the material desiccating, had become more viscous. It is commonly under these latter forms, that *honey-dew* is seen; and it is not surprising that it was never suspected to be transpiration.

In the season when I met with the *honey-dew*, in globules, on the green oak, the tree bore two sorts of leaves; the old were of a firm texture, like the holly and other evergreens, and the new ones tender, having recently exfoliated. The *honey-dew* is found only on the old leaves, notwithstanding they are covered with the tufts of the new growth, and consequently secure from every species of mist which could fall. This sufficiently proves that *honey-dew* is not extraneous or foreign to the leaves moistened with it, and that it does not fall on them, as is vulgarly supposed, inasmuch as the new shoots of the green oaks, which are most exposed, and of course would be first touched, have not, however, a single drop of it.

The same singularity struck me, respecting the *honey-dew* of the bramble. Although by the conformation of this shrub, all the leaves were nearly equally exposed to the air, or to the fall of any thing vertically, there appeared no *honey-dew* but on the old leaves; the recent ones had no more of it than the new shoots of the oak, which have been just noticed; the honey-juice, doubtless, not having had time sufficient to be formed in the tender part of these vegetables, or to be extracted or separated from the sap. It is probably the effect of a long exposition to the air, perhaps to its irregularity, and especially to the influence of the sun, to which we ought to impute the true agency of this secretion.

Moreover, the plants and shrubs in the vicinity of these *honey-dew trees*, but of another species, and of a nature less proper for the formation or secretion of the juice of which we speak, *did not bear the smallest vestige of it*. There was no appearance of it on the ground about these trees, or on the stones or rocks, where the *honey-dew*, although dried, for a long time, leaves spots, as we shall see hereafter, in

treating of another honey-dew, which falls from trees on the ground, but which never falls from a greater height than the leaves of the trees; and which is a new proof that this first species of liquid manna, comes not from heaven, nor the clouds, like mist; because it would then sprinkle indifferently all sorts of bodies, and would not affect some particular vegetables, and even some parts of the same vegetable, to the exclusion of every other.

It is true—and it is the only objection which presents itself—it is true that the dew, according to the experiments of M. Dufay, is attracted by certain bodies, when it is not so by others. But it is known that this meteor, which most frequently rises from the ground, floats continually in the air, subject to the least breath and to the weakest attraction, and often attaches to the under, as well as the upper sides of the leaves of trees. If it fell like mist, it would moisten indifferently all bodies. The acceleration of its fall would cause it to surmount the obstacle of little repulsions which it might meet in its way. It will be seen in the sequel of these observations, that *honey-dew*, reduced to very minute drops by another very natural way, and which I believe hitherto unknown, shows no predilection, in its fall, to one sort of body in preference to another, but adheres to all alike.

The ancient naturalists, of whom historians are the echos, have for a long time amused their credulous readers with showers of blood, and of other matters more solid. That of *honey-dew*, which partakes less of the marvellous, was still easier to imagine, because it was seldom observed on the trees, except when thick clouds appeared in the air, during the hot weather of June and July. *Honey-dew* does not, however, proceed from that cause. The clouds do not concur in its production, except by the increase of heat which they cause, by reflecting the suns rays towards the earth. The ordinary heats have no other effect, than to cause the most volatile juices of plants to transpire; whereas that heat which is raised to a higher degree, expresses from them the more fixed and viscous juices, such as that of *honey-dew*.

The strainers through which the honey-dew filters to the bottom of flowers, are *more*, and also *larger*, than those of leaves; inasmuch as there is always some of that juice, in the nectarine vase, so long as the plant flourishes, even in the season most unfavourable to transpiration. It has been

found in the flowers of the arbuste of the fields, in the month of November, and the bees would go thither to forage, when invited even by the smallest portion of sunshine. But what still further aids the illusion on the pretended fall of honey-dew from the upper atmosphere, is, that it is only the upper part, or side of the leaves, which is moistened with it. It has been seen above, (page 63) that the moisture comes only on certain leaves, that is to say, on the old and the least exposed, and this predilection cannot be the effect of chance. Besides, it is known, that it is on the side of the leaf, where the pores are most open and marked, that the greatest transpiration takes place. It is there that the excretory vessels terminate, by which the humours of the plant escape. And also the absorbents, which serve for their nutrition, by attracting moisture from the rain, and from vapours floating in the air.

From the combined proofs just presented, it is certain that the first kind of *honey-dew* transpires *from* the leaves of certain trees, and that it does not fall *on* them. It would be unreasonable to fatigue this illustrious assembly, and would seem to distrust the penetration and intelligence of those who compose it, to insist further, by additional proofs. I haste to pass to the other kind of *honey-dew*, first mentioned, with that on which I have just treated.*

No one has yet observed (that I know of) *this second species*, the only resource left for bees (or nearly so) when spring has passed, with the greater part of the flowers which embellished it, and that the *honey-dew*, by transpiration, yields only for a few days, in very warm weather.

The origin of this second *honey-dew* is far from being celestial, being produced immediately by a vile and hideous insect, or what seems to be so; and (for it must be named) it proceeds from a filthy bug, (puceron,) and is the very excrement of that puceron, ejected from its rear, or discharged from its posteriors. This ejection, however, is a component part of the most delicate honey on which we regale. But without pausing, with the vulgar, at names and prejudices, it is certain that this excrement, which is fluid, and which deserves rather the name of *elixir*, yields in nothing to that which the other *honey-dew* possesses, of the *sweet and agreeable*.

* These observations were read at the sitting of the Royal Society of Sciences, at Montpellier, December, 16th, 1762.

These pucerons extract this liquid, or that which is the material of it, through the bark of certain trees, without injuring them, or causing any deformity, as another species do, which crisp the leaves, or of that kind whose puncture produces hollow protuberances in the elm and pine. They remain immoveable, many months of the year, occupied at their labours, that is, extracting the sap on which they subsist.

These insects, instinctively informed of the kind of branches most convenient for them, disdain those which are tender, or recent, although much easier to pierce, and attach themselves to branches of a year old, in which they pierce a dart, which serves them, at the same time, as trunk and sucker.*

It is in their stomach, abdomen, or posterior passage, that this juice, at first rough and unpleasant, under the bark, assumes a sweet savour, quite equal, to judge of it by the taste, to that of the vegetable *honey-dew*, as well that which transpires from the leaves, as that which is secreted in the nectarine cups of flowers; and if the latter has any thing more, it is the mixture of essential oil of flowers, which gives to honey its different flavours.†

These pucerons are the only animals, which I know, that really fabricate honey. Their viscera are the true laboratory of it. This mixture of materials, or a large portion of it, is only the excess, or residuum of their nourishment, which they discharge, as we have said, in the ordinary way. The bees, to whom it is our wish to pay due honour, have no part or lot in the matter, except in the address, or ingenuity, which they display, in amassing the different kinds of *honey-dew*. They place it, as is well known, in *entrepot*, in a kind of pouch, which they have near their mouth, to empty it into their cells, as into a magazine, without making the least sensible change or alteration in it.

I have proved this oftentimes, by catching bees on their return from foraging, and pressing their corslet between my fingers. I have even seized by the throat some of those large

* It is to the shoot alone of the preceding year that they attach, and not to the older or younger shoots.

† I planted at Sauvages, says M. Boissier, near an apiary, a hedge of rosemary. Since that time, the honey of the hives, which before had no peculiar odour, was perfumed with this plant, the flowers of which supplied the bees a long time.

drones which are hairy, and variegated with two or three colours, who gain their living by the same trade. Keeping myself always on my guard against their stings, I have obliged them to surrender the liquor which they had just collected and swallowed. The large drop which came out of the mouth, and which I sucked from the animal itself, was of clear transparent yellow, and appeared to me of the same quality as the ordinary *honey-dew*, the taste of which was familiar to me.*

I have observed two species of these pucerons, which live without shelter, on the bark of young branches. They are naked and without wings. I speak of the females, which form the mass of the population, and are the only ones that work at honey making. Each family has, besides, two or three males, with wings, in their suite. These are useless mouths, which live on the labours of their companions. At least, I have always seen them moving about carelessly, over the backs of the female troop, without troubling themselves as they (the females) do, with sucking the bark.

Both kinds live in society, and inhabit in little balls or pellets, on different parts of the same tree. These bugs keep themselves crowded together, all round the branch, the bark of which they entirely conceal. And, it is remarkable that their attitude is apparently very incommodious; but every kind of animal has its own usage or custom, and the usage of these insects is to crowd together as closely as they can, tail up and head down. It is to be presumed there are reasons for their doing so, which I shall presently develop. We will observe, in the mean time, that the smaller of the two species of insects partake of the colour of the bark on which they live, and which is most commonly greenish. They are, moreover, distinguished by *two horns, or two small fleshy threads*, strait and immoveable, which rise perpendicularly from the lateral and inferior parts of the abdomen, one on each side. It is this species which lives on the top of the bramble, the elder, and young apple trees.

The other species, more than twice the size, is what I have principally in view, because they distill the honey

* In my observations, which I give in the next chapter, it will be seen that I am not entirely of opinion with M. Boissier, on the quality of that excrementous honey, dejected by the pucerons. It is not yet honey, nor will it become so, till after it has been elaborated in the stomach of the bee.—*Author.*

dew which the bees collect. This kind is blackish, and has no horns, like the preceding; but it is marked on that part of the skin with a small black pustule, or button, shining bright as jet. Biassed by what some naturalists had advanced, and others repeated, I thought that these horns, as they asserted, carried at their ends a liquid which the ants went thither to suck. But on observing a little closer, I found that what attracted the ants was ejected from a different part, both in the large and small pucerons, and that it did not exude from the horns of the latter more than from those which the caterpillars have on their tails.

Some bees afforded me an opportunity to inform myself on this point. Their buzzing in the midst of a tuft of green oak, induced me to suspect that some pressing interest had attracted them thither. In fact, although it was not the season of *honey dew*, which I had known, nor the place where it was usually found, I saw with surprise, the leaves and branches in the middle of the tuft covered with it. It was a festival for the bees, who, grumbling, collected the *honey drops*.

The singular form of these drops attracted my notice, and occasioned the small discovery which I now report. In lieu of being rounded, like drops which had only fallen, these formed, each a little oval, much elongated. It was easy to discover whence they came. The gluey leaves, to which the bees attached themselves, were directly under some of those groups of the large black pucerons. On examining them, I perceived some from time to time, who raising their abdomen, showed at the end of it a small tear of transparent liquor, of the colour of amber, which they, the instant after, threw off some inches distant. I put some of these ejections, which I had received on my hand, to my mouth, and found they had the same taste as those which had already fallen on the leaves. I had occasion to see the same manœuvre in the smaller species, or among the horned kind. They ejected the drop from the same part, in the same manner, and in a situation precisely similar.

This ejection, moreover, which alone gives the drop an elongated form, is by no means done by chance, nor is it a matter of indifference with those insects. It seems, on the contrary, to have been regulated by a sage police, to preserve cleanliness among this little people, or to guarantee from pollution, both the insect itself, who throws his excre-

ment such a distance, and also his comrades pressed around him, who without this manœuvre, would be englued and unable to act.

It is a fact well understood, that if the drop passed out without effort, the insect which delivered it being placed, as we have said, his tail up, and head down, the excrement would fall on himself first, before his companions could be spattered with it. But what advantage, it may be asked, is there in this whimsical position? There is every appearance, that in the manners of these insects, there is nothing offensive in the mode; that it is even necessary, at least it is to them very commodious, for projecting the drop with advantage.

To judge fairly of it, it is only necessary to observe, that their abdomen is twenty times greater than the rest of their body; that is, their head and corslet taken together. It is as much as they can do, to drag it slowly after them. But if the insect was in an attitude, contrary to that in which we see him, it would be very difficult for him to raise that heavy mass, when he wanted to be relieved from the press, that the expulsion of the drop might clear the troop, and pass beyond: instead of which, by having the head down and the abdomen exposed, these insects make much less effort by bending a little forward when they feel a necessity. However, with all the advantage which this situation affords them, it appears that they still make a great effort, as it were, to collect all their strength.

I have not observed them to keep this position continually, but only in fine weather. When winter approaches, the cold or the rains oblige the pucerons to range on the side of the branch best sheltered. As they at this time extract but little juice from the bark, and their dejections are less frequent, they place themselves indifferently, their abdomen up or down. The cold increasing their strength, obviates the disadvantage of the last attitude, for raising the abdomen, and raising the anus in such a way that the neighbours may not suffer by it. If it were not so, it would be worse for those who would be englued. In this bad season, the pucerons only languish, and each lives, and arranges himself to the best of his knowledge and ability.

The drops of this liquid, projected, fall on the ground, where there are no leaves or branches to intercept them, and the stones remain spotted a long time, if no rain comes to wash them out. This is the only kind of honey which

rains, or falls, like dew. But it never falls from a point higher than the branches where the groups of pucerons are fixed.

This last circumstance, and the one immediately preceding, have given me an explanation of a phenomenon, which formerly embarrassed me. I was passing under a linden tree, (tilleul) in the king's garden at Paris, when I felt some very minute drops fall on my hand, which I at first took for mist, I should have been screened from the mist by the shade of the tree, but, on the contrary, I avoided it by passing out of the shade. A bench which stood under the tree, was shining bright, and, on touching it, I perceived a glutinous matter, which was *honey-dew.*

At that time, I knew nothing of any kind of *honey-dew,* but that which transpires from vegetables. How, said I to myself, can a substance so viscous fall immediately from the leaves, in so small drops, when rain water cannot detach itself from them, and overcome its natural adhesion, till after it has combined in grosser masses? I did not, at that time, conceive of the *honey-dew* ejected by those pucerons. I satisfied myself, however, that it was some of their work, having since known that the linden tree is very subject to these vermin, and that it is one of the kinds of trees which abounds in this sort of *honey-juice.*

The honey-bee is not the only insect, as we have already insinuated, which makes its delicacies of it. The ants have claims on this nectar, quite as well established, and in which they are quite as epicurean. Some naturalists have before noticed the appetite of these latter, without knowing the reservoir of that which is the object of it, viz. the pucerons. They move round the swarm of these insects, to spy the moment when the manna drops. Very different from the bees, the ants, which live from hand to mouth, or from day to day, work only for themselves, and we never profit by an excess of harvest from them.

Two sorts of ants go in quest of the pucerons; each has its separate district, and never sports on the pleasures of the other, though weaker. The large, black *wood-ants,* have their department over the black pucerons of the oaks and chesnut trees. The smaller ants pursue the green pucerons on the elder and bramble, (ronce.) The pincers of neither are suited to pick up or collect the *honey-dew,* which spreads over the bodies on which it falls. They abandon this to the bees, who are employed below, and establish them-

selves at the source, to seize the instant, as we have already said, when the desired liquid appears in form of a drop, at the end of the anus.

The ants are not accused of idleness: those of which we now speak are constantly, and without relaxation, at their posts, around the pucerons. They wait the favourable moment, with gaping mouth and open pincers, to precipitate themselves on the first drop which appears; if it escapes them, they only resolve to be patient, till the appearance of a new one may promise better fare.

Certain plants furnish only a scanty extract to the pucerons, and the portion of it rendered by these insects, is almost wholly taken off by the small ants. It is easier for these latter parasites to seize on every part of this liquid excrement, because that *of the little pucerons*, stops a short time at the point of the anus, before it is projected, which deprives the bees of every hope of collecting any thing after these little ants.

Other trees, such as the oak and chesnut, furnish much more of that elixir to the large black pucerons, particularly when those trees are full of sap. But, in recompense, the excrementous drop hardly makes any stop; it is projected immediately, and the large ants do not find so much profit as in the little preceding harvest.

It is very pleasant to observe their earnestness; to see them running and vexing themselves; moving from one puceron to another; snatching at every thing, and catching almost nothing. There is, therefore, less crowd about the *black pucerons*. The greater part of the ants in their suite grow discouraged, and scarcely more than three or four can be seen where thirty might live at their ease.

The bees, who seem to live only on the desert, or what escapes the vigilance or address of the large ants, are notwithstanding much better served, having the proper instruments for collecting the scattered *honey-dew*, of which they make ample provision, and which they know how to use by themselves. If this desire, of accumulating, did not turn to our advantage, we should be induced to charge the bee with avarice, of which they would otherwise be the emblem, rather than the ant. The greatest collection is made in the time of the great flowing of sap, in the month of June, when the pucerons, on their part, find an easier and more abundant nourishment, notwithstanding they suck it through the bark. Hence their vigour increases, their population aug-

ments, and by natural consequence, the dejections become greater and more frequent.

These dejections are more rare in autumn. I have, however, seen some of them, at the end of October, on chesnuts and white oaks, which had already dropped half their leaves. Other pucerons, which, in the same time, had been more exposed to the north wind, scarcely rendered any thing. The *honey-dew*, or dejections of both, dried uselessly on the trees. The bees, at that season, preferred the flowers of the arbuste in the vicinage, and neglected the animal *honey-dew*, that is to say, the dejections of the *pucerons*.

Although these insects pierce the whole thickness of the bark, in a thousand places, even to the wood, and deprive the branches of a part of their nourishment, the tree does not seem to feel it, nor do the leaves lose any of their verdure. The dart, or sucker, which these pucerons use, is so very fine, that it is difficult to distinguish the marks of it on the places pierced. They are only gentle bleedings of a body in good order and full of humours.*

These pucerons have the merit, worthy of our attention, of being useful to us, inasmuch as, without injuring our trees, they compose a diet which honours our tables, and the bees which have the sole charge of preparing or elaborating it, allow us to partake a share.

The large black pucerons, which are detested, and which the farmers destroy pitilessly, and indiscriminately, with the

* These insects are peculiar in their natural history, an account of which I have left in the orginal language, for the benefit of the learned.

"Ce n'est point, comme on voit, l'histoire des pucerons que j'ai entrepris de faire. Je n'en ai rapporté que ce qui appartient à mon sujet. MM. de Réaumur, et Bonnet de Genève ont exposé dans de savans Mémoires ce que la génération de ces insectes offrait de curieux et d'intéressant. On sait en particulier, d'après ce dernier, que la race puceronne se reproduit non-seulement en suite de l'accouplement entre les deux sexes; mais ce qui dut alors bien étonner, les femelles, dit M. Bonnet, deviennent fécondes sans avoir eu, pendant plusieurs générations de mère en fille (car il faut ici changer les expressions vulgaires,) sans avoir eu, dis-je, la compagnie du mâle. Ce sont de vrais androgynes; et ils le sont beaucoup plus que les limaçons qui, ayant chacun les deux sexes à la fois, ne laissent cependant pas de s'accoupler réciproquement; et comme si ce n'était pas avoir déjà poussé la singularité assez loin, il semble qu'il soit indifférent à nos pucerons d'être ovipares comme les oiseaux, ou vivipares comme les quadrupèdes. Ils pondent des œufs dans une saison, et mettent bas des petits dans une autre."

mischievous class, deserve a different treatment, or rather the favour and kindness allowed to bees in the fabrication of honey. If, on the contrary, they would favour the propagation of these little animals, of which they know not the benefit, they might multiply the services which they render us, and augment the harvest of the bees.

The more we apply ourselves to the study of the different productions of Nature, the better we shall perceive, that if they do not all turn to our immediate advantage, they at least tend to other ends, which should make us admire, in their sovereign Author and Principle, an *intelligence profound, a wisdom infinite.*

CHAPTER XVIII.

CONFIRMATION OF THE PRECEDING DISCOVERY, BY NEW EXPERIMENTS OF THE AUTHOR OF THE PYRAMIDAL HIVE, &c.

When I read for the first time, some years ago, the observations of M. Boissier de Sauvages, (the foregoing chapter,) on the origin of honey, I was struck with astonishment, at the boldness of the system, of which no agronomist had ever spoken, or even suspected. This was the end of the year 1808, and long before we were able to begin our experiments on this branch of natural history, following the steps of this naturalist, I read his observations daily, with the most profound attention, and in the beginning of spring, I conceived the opinion, that this discovery might be by no means problematical; however, to remove all my doubts, it was necessary that the results of my studies and experiments should conform to those which that sage said he had obtained.

This discovery seemed to me so valuable for the advancement of the improvement of bees, an improvement which, in my opinion, ought to be extended to an infinitely greater degree, that I determined nothing should be neglected to satisfy me of its utility.

Nevertheless, all my projects and hopes vanished, when I reflected, that since M. Boissier de Sauvages wrote, in 1762, and no agronomist had answered the publication of his discovery; that Messrs. Bosc and Feburier, who had become oracles in this branch of rural economy, particularly Mr.

Bosc, who pretended to supremacy in the universal knowledge of the subject, had kept a profound silence. On the one hand, I was astonished at my own audacity, but on the other, I thought that those modern sages who commonly sow and plant in their saloons, and on their green carpets, might possibly have never seen or observed the pucerons of the academician of Montpellier, on their painted trees, nor the excrementous dejections of these insects on their mantels, I took courage.

Finally, after many fruitless researches, during the months of April and May, towards the end of June, I was arrested by a considerable humming in the branches of an old oak, planted beside a foss, which had been lopped about five or six years. I thought at first that this might be a swarm, which was rallying or settling on the tree. I examined attentively, and could see no bee flying about, but it seemed as if I could hear thousands of them humming. I climbed the tree, and soon observed a legion of bees foraging on the leaves, without flying or leaving the place; and I discovered the animal *honey-dew*, which I desired to find. But it remained for me to discover, and know particularly, the insects which dispensed it with so much liberality. I climbed a little higher on the tree, and in less than two feet above the bees, I observed the pucerons of M. de Sauvages.

This first sitting confined me from half-after two, till near seven o'clock in the evening. I quit the tree with the last bee. The pucerons did not seem to incline to repose at sunset: I left them at their work. I tasted repeatedly the liquor which they spilled on the under branches and leaves of the tree, but did not find it so mellifluous as M. Boissier announced. It retained a little of that bitterness derived from the essence and sap of the tree; but I thought that in the stomach of the bee, this substance would easily acquire the consistence and aroma of honey.

The next day I was at the rendezvous, a long time before the bees. I examined the work of the pucerons, by inspecting the leaves, bark, and under branches, on which the dejections of these insects had fallen during the night. A part of the excrementous fluid had fallen from the leaves and branches, to the ground, or on the grass. But by inspection, I computed that the dejections, from evening till morning, might be about the value of half an ordinary table-glass each night, and about a third more during the

day. I tasted the liquid, and remarked the same little bitterness as the night before. It was not yet honey.

The bees did not begin to collect till eleven o'clock, A. M.; but they then arrived from all quarters. They certainly came from different families, and even different villages. Notwithstanding, they plundered in the greatest harmony; and as soon as each had gotten its load, it set out, and directed its course towards the hive. The arrival of others was continued. It was like the successive and continued arrival and departure of a considerable population, at a great country fair. The paths through the air were covered with bees, and I could easily perceive, on each of the routes, two lines, going and coming, formed by two files of these insects.

The pucerons did not appear to me to be much deranged from the station in which I left them the night before. However, I thought I could remark a small change of place, scarcely sensible, and the group appeared more populous than on the preceding day. I might be deceived in this article; but I obtained the certainty of the existence of the dark brown pucerons, of which M. Boissier de Sauvages had (first of our naturalists) given us a knowledge. I also ascertained satisfactorily the utility of these insects to the bees, in their art of expressing the juice and sap of the oak, from the shoots of the preceding year. I continued my assiduities near this and some other oaks, where I had the same good fortune, until I could no longer find any bees upon them. It appeared to me that the pucerons became a prey to the little birds of the hedges, and that the bees, no longer finding an interest there, abandon them of their own accord, towards the end of August, in northern climates.

It remained for me to gain a knowledge of the other trees and shrubs, of which M. Boissier had spoken, to satisfy myself also of their relative properties, for the birth and subsistence of pucerons. I have made it my continued study, from that epoch; and have not only confirmed myself in the high opinion which I had conceived of the exactitude and truth of the discovery of M. Boissier, but I also found many other trees and shrubs, which that naturalist had not noticed, from which the pucerons also obtained products, of which the bees profited as well as the ants, and an infinity of other insects.

The brownish pucerons appear to me to furnish the most

of the honey material. The green are of two species. The one also furnishes juice to the bees, but in less quantity than the preceding. The other species of green pucerons, are useless to our precious insects, and pernicious to the trees. This last kind ordinarily finish their career, by enveloping themselves in the leaves of the trees on which they live, and which they crisp and destroy.

Such are the new resources for the subsistence of bees, which were unknown to us, before the observations of M. Boissier de Sauvages, the reading and study of which, have produced mine. Other amateurs of the culture of bees, and among them, M. Rosi, merchant of Redon, have also begun to make their individual remarks on this part of our natural history. M. Rosi was led to it, by seeing some stones bedewed with a viscous matter, which gave them a shining appearance, and which attracted a great many bees, near a slate quarry, which he was working. This viscous matter fell from an oak, standing near his quarry, on some refuse slate. He attributed it, he said, to the transudation of the leaves of the tree. This learned amateur made a strict examination, and found on the tree, a family of pucerons. He satisfied himself that the substance sucked by these insects through the bark of the tree, and dejected in excrements, was not yet honey as it passed out of their abdomen. It is however a proper material to produce honey, but it must be first elaborated in the stomach of the bee.

CHAPTER XIX.

OF ANIMALS AND INSECTS ENEMIES OF BEES.

Bees have a great many enemies, because they are laborious, and live in plenty. In winter, and often in summer, they are besieged by other insects, who never have any provisions, but what they procure from day to day, by robbery. Moles, rats, and the different kinds of mice, are not the most dangerous when the bees are lodged in wooden boxes, the openings of which in winter, do not present an entry sufficiently large for the passage of these animals. In this season, the openings should be no larger than sufficient for the passage of one or two bees at a time. In spring and summer, the bees are too vigorous to fear any thing from that class of *enemies*. It is known that these

small animals cannot move reversed, (feet up and back down,) it will be sufficient then, to guard against them, that the legs of the bench be placed about three inches from its border, and about two feet high.*

The wrens and sparrows give no truce to their depredations on bees. These birds are infinitely more injurious to them, than the moles and other animals of that class, because their war is continual. In all seasons of the year, these birds watch the bees, and seize on them, sometimes in mid air, and sometimes on the very benches of the hives. In winter, they may be seen rapping gently with their beaks, at the entrance of the hive, and as soon as the sentinel-bee appears, it is suddenly seized, and immediately carried off. The bird very soon devours its prey, and returns forthwith to watch for another.

Another terrible enemy in summer, is the wasp. It is continually flying around in front of the hives, skimming the ground, very little above the surface, and all bees which he meets alone and isolated, whether on the ground or on the borders of the bench, become his victims. Happily the wasp is as timid and cowardly, as he is cruel. He is afraid to introduce himself into the boxes, when the bees are in force. It is only when he knows the weakness of the population, that he dares enter the box.

The more easily to destroy these mischievous wasps, the apiary should be kept neat and clean, that they may the more easily be discovered. Some morsels of meat, either raw or cooked, should be thrown down before the hive; of this they are very greedy, and when they are occupied on their pillage, they may be easily destroyed, by beating them with a furze bush, or broom. Their retreats in the fields should be hunted and burnt.

Wasps do not exist in winter. They all perish at the end of autumn, by cold or famine. But at the end of June, or the beginning of July, the eggs of the preceding year, hatch, and produce new wasps. This is a fact well verified.

Spiders, says M. Rosier, are inimical to bees, not on their provisions, but on the bees themselves. They are carnivorous, and not satisfied by honey, which they despise. If they can penetrate into the hive, unknown to the bees, they fix on some corner to spread their web, to en-

* See page 50. How does this tally with legs ten inches high?

snare those bees who have the imprudence to let themselves be caught. The ravages which these spiders commit, are too inconsiderable to injure the population of the hive; but bees, who do not accommodate themselves to such filth, abandon their domicile, if they cannot get rid of them.

It is during winter that the spiders insinuate themselves into the hive, without being perceived by the bees. The avenues are too well guarded in summer, to allow them to intrude into the hives, when the bees are full of vigour and courage. When the hives are to be cleaned, it is essentially necessary to examine their interior, and to remove the spiders, who ordinarily spread their webs in the corners, and but for these webs, the bees would extricate themselves from this sort of enemy, who have no weapon to oppose the sting.

The most dangerous and redoubtable enemy of bees, is the *false moth.* This is a little caterpillar, produced from an egg laid by the phalene or night butterfly, which often destroys itself in our apartments, in the flames of candles, and which lay their eggs in tapestry and other stuffs. This same kind of butterfly, on the return of spring, is very common in the country; they are seen in swarms about old oaks, where they are hatched in the mosses on the bodies and branches of trees. This butterfly flutters day and night around bee-hives, and they often introduce themselves into the hives, when the families are weak, and not well guarded by the bees. They lay their eggs in the combs. The concentrated heat in the hive, hatches them; little worms come out, which live as young bees do, without the care of *father*, *mother*, or *nurse;* and these little worms become caterpillars, which are known by the name of false moths.

M. Varombey, author of the French hive, in his treatise on the culture of bees, gives a perfect statement of the ravages of these insects, which, at first almost imperceptible, nourish themselves on the wax, which had served them for a cradle. While they are growing, they spin themselves a silken envelope, for a retreat—at first very small, but afterward as large as the bowl of a quill. These redoubtable miners, perfectly secure in the midst of their enemies, extend their ramparts as fast as they consume the wax. For the purpose of eating, they extend their head, armed with a casque or helmet, out of the shell or case which conceals them, and thus carry on their robberies peaceably,

setting at defiance the stings of the bees which they rob. As the moths grow, their ravages increase. The bench of the hive is covered with the wreck of the hashed combs, the honey flows from the gnawed and broken cells, the couvain falls from its demolished cradle, and the bees, discouraged, abandon a dwelling, where they no longer enjoy in peace the fruit of their labours.

To prevent the attacks of the false moths, care ought to be taken to have none but strong hives, whose wax is not too old. But in the pyramidal hive, the wax has not time to grow old. Each case is removed in the second autumn: the honey is removed the same year that the upper box is removed. Thus, this caterpillar is not dangerous to the pyramidal hive, where it cannot penetrate, much less cause any considerable ravages. In the pyramidal hive, there are no lateral openings, as in the French and village hives. The only opening in a pyramidal hive, for communication between one case and another, has only a thread of wax, about the thickness of a little finger, which attaches the combs of the upper box, to the next below. This fixture, between the combs, serves the bees as a ladder, to go and come, ascend and descend, from one box or story to another; but the moth cannot pass that way.

Lice are sometimes observed on bees. This kind of insect indicates the antiquity of the hives, and the necessity to change the boxes. This vermin is never found in the pyramidal hive, because the boxes are changed too often for them to breed.

Frogs, lizards, and toads, feed on all kinds of insects, disseminated on the herbage, and if they find dead or stupified bees, they make their profit by them, but their ravages are inconsiderable. Nevertheless, if these animals are found among the hives, or in the environs, they ought to be destroyed.

CHAPTER XX.

ON HYDROMEL.

Hydromel is a beverage prepared with honey and water. It is made of different qualities, according to the use for which it is destined. There is the simple, the compound, and the medicinal. The manner of preparing is nearly the same in different factories, varying, however in different countries, in the greater or less *quantities* and *qualities* of

the material, also in the difference of coction. We will here give the various modes of preparation, for the better information of the country people. We will also state the different processes recommended by divers practical agronomists.

A great deal of hydromel is consumed in the north of Europe. Hydromel is the ordinary beverage in Russia, Sweden, Denmark, &c. This drink is not used to a sufficient extent in France. It would be of great utility in the vine countries, in years when the vintage is not sufficient to meet the foreign demand and home consumption. The same consideration ought to have place in cider countries, when the harvest of apples does not furnish the necessary quantities.

Simple hydromel, is made only with honey and common water; and when it has acquired a strength equal to wine, either by the quantity of honey put into it, or by boiling, or by fermentation, it is called *vinous*.

To make vinous hydromel, requires one pound of honey to three pints of water. The most beautiful honey, (called mother drop,) the newest, and most agreeable to the taste, ought to be employed for this liquor. The honey of Narbonne, when the white honey of other countries cannot be furnished, produces hydromel superior to that made with the honey of Bretagne. However, when these last are well prepared, excellent hydromel is obtained. The honey must be wet with water, in a tinned copper vessel, and the mixture boiled gently over the fire, until it has acquired a consistence sufficient for a fresh egg to swim in it, without sinking to the bottom of the vessel. Care must be taken to skim the liquor while boiling. When this is done, it must be strained through a linen cloth, or hair seive; then about half of it must be poured into a new barrel, washed repeatedly with boiling water, and afterwards with one or two pints of white wine, that no disagreeable odour may remain. When the barrel is full it must not be bunged, but the bung-hole only covered with a piece of linen cloth, to prevent any filth falling into it. Then it must be placed in a stove, or in a corner of a chimney, in which a little fire must be kept day and night, to keep the liquor gently warm, and make it ferment.

The other part of the hydromel is to be put in bottles, or into very clean earthen jugs, with narrow necks, observing not to cork them, but only cover them with a linen cloth, like the barrel, and set them within the chimney.

This bottled hydromel serves to supply the waste occasioned by fermentation in the barrel, which fermentation should continue about six weeks. After that time the barrel must be stopped with a bung, enveloped with a small piece of linen. It must not be driven in too deep, because it must be occasionally taken out to fill the barrel, which must be placed in a cellar, and there remain during winter. When it is observed that the hydromel ceases to condense, or shrink in the cask, and that there is a continual froth round the bung, it may then be driven home, and the barrel must remain unmoved till it be tapped to put the hydromel in bottles.

It would be much better to make the hydromel ferment by isolation, that is to say, by exposing it to the sun. But as the sun is not always above the horizon, its heat cannot produce a fermentation, either so equal or prompt as that which is produced in stoves or chimneys. This might be remedied by moving the cask into a warm place every evening towards sunset; but that would require much care and address, not to disturb the lee which collects at the bottom. This lee is of a brown colour, and much more liquid than that of wine.

The consistence of vinous hydromel approaches near to that of sirup, and its taste that of Spanish, or Malvoisie wine. It is cordial, and stomachic, and dissipates winds, or flatulencies; cures colics which proceed from them; aids respiration, and resists contagion. The simple, ordinary sirup, is made like the vinous, only that it is not allowed to ferment.

To make compound hydromel, while the quantity of water and honey before mentioned, for the preparation of simple hydromel, is boiling, take Damascus raisins, in the proportion of half a pound, to six pounds of honey. These must be cut in two, and boiled in four pints of water, till the quantity be reduced one half. The liquor thus diminished, must be strained through a cloth, with a light expression of the raisins. It is then to be mixed with the hydromel, and the whole boiled together for some time. Afterwards a toast of bread, soaked in beer, must be put into it; and having skimmed the froth newly formed, the liquor is to be taken from the fire and left to settle. It must then be gently decanted, or poured off, to separate it from the sediment, and put into a cask, as before prescribed; in which must be first put an ounce of the best salt of tartar, dissolved in a glass of spirits of wine. Care must be

taken that the cask be full. After that it must be exposed to the full heat of the sun, or in a very warm stove-room, taking care to fill it till it ceases discharging froth. Having filled it for the last time, it may be stopped close and moved into the cellar, where having remained some months, it may be drawn off and bottled.

This compound hydromel is excellent to fortify the stomach, particularly of those who are troubled with the heart-burn; to suppress the vapours which cause headachs; to remove obstructions in the lower bowels; to cure the phthysic, asthma, and all pulmonary complaints.

To render this compound more agreeable, five or six drops of the essence of canella, may be mixed with the spirits of wine, in which the salt of tartar is dissolved. The rind of citron, or orange peel, raspberries, flowers and aromatics, as may suit different tastes, may be infused in it. This liquor may be used in place of wine.

Thus M. Chomel, in his Economical Dictionary, has given us the method of making simple and compound hydromel; and as those who have written since have added nothing to the excellence of his process, we have thought it our duty to publish it for general information. But as M. Chomel, and those who followed him, wrote only for the richer class, they omitted to give the method of making common or ordinary hydromel, such as is used by common people in town and country.

This common or ordinary hydromel, is prepared like the simple vinous hydromel, with the exception that it is not fermented, and the quality and quantity of the honey may be inferior, and in smaller proportion, to the quantity of water used. With two pounds of honey, and twenty pints of water, very good common hydromel is made, by boiling them together over a moderate fire, till about one-third of the water be evaporated, or till an egg will swim on it. The liquor must be skimmed, and put into a cask, and the boilings and skimmings of the honey and water, in like protions, must be repeated, and continued to be poured into the cask till it be filled. It must be left two or three days to settle, when the cask may be tapped for use. This liquor may be made more or less *generous*, (this is the technical word in the country,) in proportion to the quantity of honey used. And this depends on the ability of the people who make and drink it. It is stomachic, and absorbs the sweat of the labourers exposed to the heat of the sun, in the

time of harvest, threshing the grain, &c. It is inebriating, if drank to excess.

Vulnerary hydromel is often made with decoctions of vulnerary herbs and a little honey, as a beverage for those who have pulmonary diseases.

CHAPTER XXI.

PROCESS FOR CONVERTING HONEY INTO WHITE INODOROUS SUGAR, BY MR. FOUQUES, CHEMIST, EMPLOYED IN THE SOUTH OF FRANCE, BY HIS MAJESTY THE EMPEROR AND KING, TO TEACH THE ART OF MAKING SUGAR WITH INDIGENOUS MATERIALS.

Beautiful sugar can be made with the honey of Bretagne, if nothing but an excellent whiteness and savour be required. But it ought not to be expected, that sugar could be obtained, having all the qualities of that made from cane.

A white saccharine matter can be extracted from it, resembling the fine sugar of cane, but it will never attain that degree of brilliant crystallization of cane sugar. It will crystallize in small particles, resembling grains of millet.

Honey can produce two very valuable articles at the same time, viz. concrete sugar and sirup, very much resembling that made of Muscovado sugar.

To proceed in these operations, it will, at first, be necessary to be provided with an areometer, which is used to weigh the sirups, and two or three strainers, to filter the liquid. It will also be necessary to have a copper basin, with a flat bottom, and not deep; and finally, a furnace proportioned to the basin.

When the proper time has arrived to commence the operations, the honey is put into large earthen pans, and exposed to a great degree of cold. It must be covered with a thin cloth, to prevent any filth from falling into it. By this arrangement, the honey will crystallize to its maximum. When the honey is thus crystallized, it must be taken out of the pans, and put into sacks of strong white cloth. The mouths of the sacks must be tied and submitted to the press, at first lightly, lest the sacks should burst, afterwards a little harder, and finally, as hard as possible.

The cakes are then to be taken out of the sacks, crum-

bled and rolled between two cloths, and afterwards replaced in the sacks, and pressed over again.

When, by repeated pressing, the honey as well as the sacks remain dry, it must be taken out, and dissolved in water, and a pound of bullock's blood mixed with a hundred pounds of honey.

This liquid must be placed over the fire, and be carefully skimmed as long as any scum or froth arises. And as soon as it raises the areometer to twenty degrees, it must be poured off into a strainer, in which there has been put clean ashes, (one-fourth full,) sifted, and repeatedly washed, and there left to filter. It may remain about eight days, and if it has not thickened at the bottom, it must be put over the fire again, to reduce it. Charcoal, beat as small as peas, must be put into it, while boiling.

This charcoal should first be put into an iron riddle or sifter, and washed as long as any of the pieces will pass through. The fire must be kept up as brisk as possible, and when the ebullition of the sirup shall mark the thirty-fourth degree on the areometer, it must be poured into a hair sieve placed over an earthen pan: at the end of three or four days, it will be crystallized.

If it be not white enough, it may be crumbled again, and put into the cloths, and pressed. By repeating this last operation, it will become very white, particularly if in the last pressing, the cloths are a little humid.

When the sugar shall become sufficiently white, it may be dried in the air. If it be wanted in loaves, it must be put in a saucepan, in or over boiling water. Although it be dry in appearance, it will dissolve by this mild heat, and it may be poured into paper, whence it may be taken out, when it shall become cool. In this state, it will sweeten as freely as sugar of cane, but it may require a little more of it.

A valuable sirup may be made from the washings of the sacks, in which the several preparations have been pressed, and also from the washings of the charcoal, and the scum of the boilings. It would rival the sirup made from the best muscovado or refined sugar.

Note.—There is no kind of liquor or ratafy, which cannot be made of this sirup, as perfectly as from the sirup of refined muscovado sugar.

That kind of Martinique liquors, known by the name of *Madame Amphoux*, and since by that of Grand Mai-

son,—are perfectly imitated by this sirup of honey, of Bretagne. It has become a very considerable article of commerce; and the famous epicures and gastronomes of Rocher de Concale, at Paris, who daily indulge in it at the close of their banquets, swear by the rum of Martinique.

All sorts of comfits are perfectly prepared with the same sirup. The skill of the artist contributes more to the goodness of the composition, than the difference of the material, when the honey sirup is well prepared. But confectioners and distillers ought to be silent, lest they awake a prejudice which would otherwise soon cease.

CHAPTER XXII.

PROCESS FOR PURIFYING HONEY IN SMALL QUANTITY.

Take honey, six pounds; water, one pound; powdered chalk, two ounces and a half; pulverized charcoal, washed and dried, five ounces; the whites of three eggs, beat in three ounces of water, for each pound of honey.

Put the honey, water, and chalk, into a copper vessel, and boil it about two minutes. Then add the charcoal, stir and mix it well with a spoon or spatel, and the boiling continued about two minutes more. Then take the vessel off the fire, and let the liquor cool about a quarter of an hour; and then strain it through a hair sieve, taking care to return the first drippings into the sieve, because they always take with them a little of the charcoal. The liquor thus filtered, is sirup properly prepared.

CHAPTER XXIII.

ON DISEASES OF BEES.

Bees are not subject to any habitual disease. The only one with which they are sometimes, but not often, dangerously attacked, is the dysentery. And this only happens accidentally, when early in spring, they forage on plants which are familiar to them in summer, and at that season nourishing; but whose juices at so early a season, not being proper for the fabrication of honey, corrupt on the stomach of these insects. This never occurs except in

time of dearth; when the spring seasons are rainy, and the vegetation late.

Every writer on bees, has given his opinion of the best remedy and cure of this disease. Bees ought to be well nourished. The flour of oats, beans, Turkey wheat, and maize, well sifted, have always appeared to me to be sufficient to preserve them in good health. Whenever I observe any drop of dysenteric dejection on the bench of the hive, I supply them with flour mixed with fine common salt. To prevent the disease, I begin about the end of January, and put a plate of flour and salt on the bench, in the interior of each hive. This has always proved successful.

It is said that bees are sometimes troubled with lice. It is possible that some individuals of this kind of vermin, may be met with in old hives, but I never noticed them.

CHAPTER XXIV.

ON THE PARTICULAR CARES TO BE TAKEN OF BEES, AT DIFFERENT SEASONS OF THE YEAR.

OCTOBER.

The bee year commences in autumn. This is the time to purchase hives, and the time also when the honey harvest or vintage begins. The upper stories of the pyramidal hives are to be removed, and the opening on the top of the next box, now become the upper, is to be closed. To close this opening, a small piece of plank may be placed on it, and cemented by mortar, and covered with a stone to keep it fixed in its place. The whole should be covered with a straw hood, or inverted earthen vase, to preserve from humidity the two boxes which remain on the stand, during autumn and winter; and the bench should be cleaned, and rubbed with thyme, or some other aromatic plants. No pyramidal hive should remain in the apiary, after the end of October, except it be intended to reserve some honey in the boxes, to preserve early spring fruit. The openings for the entrance of the bees, should be diminished, several openings however may be left, each large enough for the passage of only one bee at a time, to prevent the entrance of moles and other obnoxious animals. This is

the proper season to preserve all kinds of autumnal fruits. Apple and pear jellies may be made, and quinces perfectly preserved with honey. This is the season also to prepare sirups to feed the bees in the latter part of winter and beginning of spring, particularly late and weak swarms, which are in danger of being lost in bad weather. These sirups may be composed of the mast of wine, cider, perry, or hydromel, and one pound of honey to each bottle of either of the liquors. To some of the bottles a handful or two of salt may be added, in case the dysentery be apprehended. This amalgam should be boiled on a slow fire, to a proper consistence, and then bottled for use.

NOVEMBER.

In this month a new visit must be made to the apiary. It will require two men to raise the two cases of the Scottish hive, and to hold them up without separating them, while a third rubs the stand perfectly clean with aromatic herbs or plants; the hives should then be weighed, to ascertain how much the bees have consumed in the first months of bad weather. The late swarms should not be neglected, and if it be judged necessary, they may be nourished within their hives, by meal of oats, maize, wheat, potatoes, or buckwheat. Whichever kind is used, some fine common salt should be mixed with it, the whole sifted, put on plates, and set on the stand within the hive.

If any of the late swarms should have died since the preceding visit, their boxes or panniers must be removed and wrapped in packcloth, to secure them from spiders and night millers. They must be kept in a dry place, secure from rats, mice, and other noxious animals, to be used for receiving new swarms on the return of fine weather, or to be self-restored if the panniers be full, or even three-fourths full of combs, well preserved. See Chapter XIV., on the re-establishment of dead swarms.

DECEMBER.

The same cares and attentions are now required as in the last month. The different families must be weighed, in their panniers, and those which are Scottish must be weighed in their double boxes, without separating them. The quantity consumed by the bees can be thus accurately ascertained, and a correct judgment formed of the sufficiency of subsistence, by the weight which remains. If

any families have perished, it is known what must be done with them. At each visit the hoods of the hives must be noticed, to ascertain whether any vermin have taken possession, that if so, they may be destroyed.

When the hood is removed, you can take the opportunity of renewing the farinaceous preparation mentioned in the direction for the last month, first neatly cleaning the bench, before replacing the plate with the flour and salt. At this time also, they may be supplied with some of the sirup before spoken of. This should be put into an earthen cup, about the diameter of the hole on the top of the box. The mouth of the cup should be covered with a piece of new cloth, doubled, and fastened with a pack thread. The cup must then be reversed, or put mouth down over the hole, to which it will serve as a stopper. The sirup will percolate gently through the double cloths, and the bees will repair to it in continual succession, and pump out with their trunks the restorative liquid, the effect of which, united to the farina and salt, assures the health of the bees.

In the two months of November and December, and also in that of January, bees do not often go out; nor ought they to go out to procure subsistence. During the severest cold, they remain, grouped together, in the upper part of the box, on the combs supplied with the eggs of the queen, laid before the destruction of the drones the preceding summer. They remain there continually, as if to guard this hope of their country. They are crowded one to the other, and remain in that state till a milder air reanimates them, and inclines them to seek nourishment for support. Small grates should be placed over the openings of all the hives, as soon as severe cold begins to be felt. These insects would be exposed to destruction, in the three winter months, if, deceived by the serenity of a few fine days, the proprietor would allow them free egress.

JANUARY.

The same cares and attentions as in the two preceding months. If much snow has fallen it must be removed from the hives, and the greatest care must be taken, to preserve them from humidity, without depriving them of the free circulation of the air. Fewer bees die, in the hives, by cold, than by the humidity which by negligence is allowed to penetrate their dwellings. The air ought to be renewed from time to time; hence the recommendation to cleanse the

benches, because during this process the air is introduced more freely into the hives, than through the grates at the bottom of the boxes.

To perform this operation, a dry time should be chosen, and never attempted in a moist season. It is important in winter, to keep up a free circulation of air, through the small grates. If snow falls in the night, it must be removed in the morning; and, if it falls during the day, the grates must be cleared of it before night. By these little cares, more minute than troublesome, the integrity of the colonies is preserved. It may be observed, perhaps, that in the wilderness, in our forests and rocks, the wild bees receive none of these cares from the hands of man, and yet they succeed! This is doubtless true, but I know that it is the hatching of the couvain, on the return of warm weather, which perpetuates the colonies, and renews them every year.

FEBRUARY.

In addition to the cares of visiting the hives, purifying and ventilating them, and renewing the supply of food and cordial, recommended in the preceding months, the projected plantations should be continued, for the embellishment of the apiary, and the preservation of spring swarms. The ground should be dry, and prepared for forward flowers, many varieties of which should now be sowed. The bees from whose hives we remove the grates, immediately essay their strength on the wild almond, and lay the buds of the saffron and violet under contribution, which require only a few good days to blossom, and expose their treasures to the diligent bee.

The attentive proprietor still keeps the bee grates under his command. He does not permit these first little indiscretions of the bees, only in the driest and most serene days, and then only from eleven o'clock in the morning till about two afternoon. This is the time in which they return to the hives. And the wisdom of their instinct recalls them thither, with more certainty and regularity, than strict reason recalls our frisky youth from the frivolous pleasures of a ball.

MARCH, (OR MARS.)

March is come, the god of battles and of glory. Our armies have heard his voice, and rallied under his standards. Already are they on their march to the *inspiring, thundering sound* of martial music. Soon will they have

passed the distance, which separates them from the Boristhenes, that famed river, which was formerly the boundary of the bold Sarmatians. They will not again behold the thick cloud, which was spread over their heads, by the too much expected sack, burning, and wild devastation of the cradle of the Czars, in their last campaign.*

In this month the bees begin to beat the field, but still with the greatest precaution and prudence. The proprietors have terminated the visits which were necessary in winter. They have scoured every thing clean, and renewed the necessary refreshments, &c. The air is perfectly purified in the hives, the passages are enlarged for the egress and regress of the bees, but in such a manner as to prevent the attacks of moles and mice, the possibility of whose entry into the hive must not be admitted. The saffron is already decaying from which the bees made a great booty. But generous Nature has spread for them thousands on thousands of other treasures. The furze, wild turnips, stone fruits, pears, and apples, in all their variety, offer them incalculable wealth, and in proportion as the weather becomes mild, they rise above, and can dispense with, the care of man.

The spring is come, followed by Flora, who here establishes a most brilliant court. The bees enjoy all the gifts of the goddess, without tarnishing their splendour. They collect an immense harvest from all the flowers which she displays to them, but they, notwithstanding, retain all the richness of their perfumes and brilliancy of their colours. It is in this principally, that the bee is inimitable. It plunders *every where*, and *no where* is any trace of its larceny perceivable. If the culture of these insects was a little more favoured, in the French empire, it would be found that their annual booty would exceed three hundred millions of pounds, without any one complaining of their excursions. This is a fact, accurately true, founded in nature. And this prodigious amount well applied, to essential wants, would spare us floods of sweat. But the difficulty in this branch of improvement is, that the means are not used, as pointed out by practical and experienced cultivators.

This is the season to change simple hives into Scottish, and Scottish into pyramidal, as before directed. (Chapters 6 and 9.)

* This may be a very pretty *French episode*, but it has very little to do with the history or the management of bees.—*Translator.*

APRIL.

In the latter part of the last month, and the beginning of this, some marks of the dysentery may be perceived, when the bees have not had all the care and attention paid them, which we have previously pointed out; because this malady is very rare indeed, when sufficient care has been taken to prevent, or check its progress, by the solid aliments and sirups before prescribed, which are sovereign remedies. (That is the farina, salt, and sirups, as mentioned in the prescription for December.)

The neuters or working bees, are already in active operation; the construction of cells advances astonishingly, and the lay of the queen is prodigious. The empty cells are instantly supplied with eggs, by the mother bee; and the drones, hatched from the couvain of the preceding year, will make it their first care to fecundate all these new eggs, which, after this operation, will, by the law of nature, hatch themselves.

The warmth of the atmosphere now begins to hatch the eggs of all oviparous insects, disseminated by nature in mosses, in barks, in chinks of rocks, &c. Among the number of insects thus hatched, is the *night miller;* the female of which tries to introduce herself into hives, to lay her eggs, which produce the most dangerous enemy to bees, viz. the moth—which is the most indefatigable and invulnerable destroyer of the combs. This miller should be watched. It may be easily taken when it approaches the hives, and should be destroyed for the benefit of the bees.

At the end of this month, the bees may be left at full liberty. However, it is the season when hungry hives commonly attack those which are better supplied, and offer no resistance. It requires all the watchfulness and attention of the people who have charge of the apiary, to preserve order and harmony among the bees. When these robbers make their appearance, a general examination of the apiary should be made; the state of the resources of each family inspected, and means devised, not only to *repel attacks,* but also to prevent the bees themselves from destroying their own resources.

MAY.

This is the most charming of all the months. All the vegetables have resuscitated from the tombs, in which they were confined by winter. They are each adorned

in the brilliant and diversified livery furnished by liberal nature. The nectar of flowers, and the *transudation* of trees, afford inexhaustible resources to the diligent bee. The magazines are filled. In the pyramidal hive, the bees occupy only the middle story, and the neuters will soon begin their fabric of combs in the under story. In the Scottish hive, the lower story is by this time generally furnished with combs, where the queen lays her eggs. As soon as the couvain is entirely hatched, in the upper box, and nothing remains to be done by the neuters, but to fill the cells with honey, and seal them up,—the whole family will be stationed in the lower box.

This is the season, in many countries, when the first swarms come off, and requires the attention of their guardians, from eight o'clock in the morning, till four in the afternoon, if the atmosphere be loaded, or threatened with storms. A burning sun, breaking through the clouds, and beaming on the hive with its ardent rays, provokes the departure of the swarm, and it suddenly leaves the hive. A new cloud for a moment obscures the sun;—it is a cloud of bees, whose balancings and undulations resemble large flakes of falling snow, agitated by the air, and vibrating a long time before they reach the ground.

JUNE.

No particular attention is necessary in this month, except to take care of the swarms which may come off. The author recommends the culture of artificial meadows, luzerne, sainfoin, vetches, rape, &c., as early food for bees, and buckwheat for continued and later food.

It was in the latter part of this month, when the sun passed from the sign of gemini into cancer, that I made the discovery of restoring hives, whose population *had perished*, by hatching the couvain, which still remained in the egg state, by the simple effect of the action of the summer sun.

JULY.

The buckwheat begins to blossom; and the bees collect a prodigious booty from its flowers. Abundant swarms are produced. The hives fill with combs. The lay of the queen is continued; and the labour of the drones, fecundating the eggs, is excessive. The upper stories are full of combs; the couvain of which, already hatched and

in activity, abandon, for the purpose of converting them into magazines, to be stored with honey. The queens, with their subjects, descend into the lower stories, where the labour is pursued with the most astonishing ardour. During the whole of this month, these insects are in a continual agitation, from the dawn of day to the twilight of evening.

In this month, all the swarms are in a situation to secure their winter's provisions, if the weather be favourable. Early swarms will sometimes produce other swarms; but it is best to make these return, either to the mother-hive, or join some other hive already well stocked with provisions for the winter. They will continue to labour, during the remainder of the season, and the hive will become very rich.

AUGUST.

In this month the bees swarm less frequently than in the preceding. But they sometimes come off as late as the 15th, and sufficiently vigorous to procure their winter's provision. The materials are still abundant. The buckwheat begins to brown in August, but the vegetation of the trees is renewed, and the transudation assures the bees a continuation of an abundant harvest. They profit by it, and accumulate their stores. The queen continues to lay, and the drones to fecundate. But this lay will not hatch till the following year. It will then *be its country's hope*, as it will furnish a new generation of *drones*, as those of the present year will cease to exist, as soon as they become useless.

In this month particularly, nature presents a new phenomenon, whose results afford the bees a prolongation of harvest, as long as the frost will permit them to profit by it. In addition to the transudation of trees, there is an *animal honey dew*, for which we are indebted to the excrementous *dejections* of small black *pucerons*, or vegetable lice, which nature has appointed to intercept and pump out the juices of certain trees, such as the maple, the linden, chesnut, oak, &c., and by their dejections to provide a profitable resource to bees, and to a thousand other insects which feed on it.

We have doubtless made as much, and perhaps more progress in the natural history of insects, than any other people on the globe; but if we carefully compare the sum

of knowledge already acquired, with that which is still to be learned, we shall be astonished at the immeasurable difference.

SEPTEMBER.

We have now arrived at the last month of the year in the culture of bees. The queen continues to lay, and the drones continue to fecundate the eggs. However, the moment approaches for the destruction of all those individuals, who are a charge on the public. From the eighth till the fifteenth of this month, (particularly in northern climates,) a general attack is made on the drones, on all points, and they are unmercifully massacred, and dragged out of the hives by the neuters. All the young queens, who have not departed with swarms, share the same fate. The massacre extends to every living being of the species of drones or queens, already hatched into worms or nymphs. But the same lot does not extend to the eggs yet unhatched, and which will not hatch until the return of spring. These unhatched eggs do not fall under the general proscription. Around and between the combs, and in the cells containing these eggs, the bees pass the autumn and winter, and protect them from the enemies of the state. They never abandon them in autumn, winter, or spring, till they be hatched. They (the eggs) are the *only hope of the country.*

The bees, however, are not diverted from their domestic labours by these sanguinary operations. Those who are accustomed to field service, go and return to the hives as usual, loaded with booty, and full of cheerfulness. Those of the interior continue to build, and the queen to supply the cells with eggs. But the fecundation of these eggs must be deferred till spring, till the birth of new drones, hatched from eggs fecundated before the general massacre. No disorder is observed among them. The morning after these tragic scenes, the upper stories of the pyramidal hives are disposable, and on the first fair night of the second quarter, or of the full moon, preparations may be made to begin the harvest.

CHAPTER XXV.

A LIST OF TREES, AND PLANTS IN GENERAL, MOST SOUGHT AFTER BY BEES.

Althea,
Apricot,
Almond tree,
Strawberry tree,
Balm,
Horsemint,
Sweet broom,
Cherries, in all their varieties,
Chesnuts,
Oaks, in all their varieties,
Succory, in flower,
Orpine, do.
Citron, and all trees of that family,
Cabbage in flower, in all its varieties,
Gourds,
Cypress,
Dandelion,
Thorns, in all their varieties,
Raspberry,
Strawberry,
Beans, peas, and vetches,
Flowers in general of all plants, (this is a sweeper,)
Furze, in all its varieties,
Golden sheaf,
Gillyflower,
Mallows,
French beans, in all their varieties,
Simple hyacinths,
Safron,
Sainfoin,
Fir,
Buckwheat,
Savory,
Sage,
Willow,
Thorn bush,
Iris, (flags,) in all varieties,
Simple jonquille,
Lavender,
Laurel,
Lentil,
Luzerne,
Lilies,
Great chesnut of India,
Balm gentle,
Dwarf wild cherry,
Mustard,
Yarrow,
Rape in flower, in all varieties,
Simple narcisuses
Oranges,
Wild marjorum,
Simple poppy, in all varieties,
Passe velour, or velvet flowers,
Parsley in flower,
Cowslip,
Burnet,
Oleaginous plants,
Pine,
Pear,
Apple,
Prune,
Prussier, or pine of Bordeaux, and all resinous trees,
Réséda, or cross-leaf,

Rosemary,	Creeping thyme,
Bramble, or blackberry,	Sunflower,
Simple roses, in all their varieties,	Service,
	Violets, in variety.

Note by the Translator.—The whole of this schedule might be condensed into a few words, viz. all kinds of flowers afford food for bees.

In the number of the preceding plants, the *golden sheaf* (*la gerbe d'or,*) should be particularly distinguished, because it begins to flower when most other plants have ceased to flower; and whose flower forms a head, or tuft, like an ear of wheat, and preserves its perfume and aroma till near the end of November. This plant is always covered with bees during the last month of summer, and the first two months of autumn, whenever the weather is favourable for the bees to go abroad. Wherever bees are cultivated, this plant ought also to be cultivated. It is perennial, grows in tufts, or clusters, and expands. It grows on the poorest lands, among heath, on chalky and limy thin soil. One acre of the meanest ground, planted with golden sheaf, would supply more than a hundred swarms of bees with sufficient nourishment in autumn, to complete their winter stock of provisions.

In general, we ought to cultivate, and have near the apiary, all the plants which begin to flower in February and March, and also, all the plants, such as the *golden sheaf*, which retain their flowers and aroma till checked by the frosts of autumn. Bees, always active and laborious, avail themselves of the latest, as well as of the earliest moments of the vegetation of all flowering plants.

All well informed cultivators of bees say, that all vegetables contain the principles of honey, and only differ in the more or less quantity. Consequently, bees can collect nourishment proportioned to the abundance of their natural food, in every country in which they live. But the vast and rich meadows, enamelled with flowers, the fields whitened with buckwheat, the plains gilded with the flowers of rape and wild cabbage, the immense forests garnished with all sorts of trees, present the bees with profusion, wherewith to supply their daily wants, and unlimited provisions to fill their magazines. The mountains, covered with rosemary, lavender, thyme, and other aromatic plants; and lands co-

vered with furze and broom, furnish an abundant supply. Their harvest continues as long as the vegetation of the plants lasts, especially in the flowering season, and when that is over, the succeeding fruits furnish immense resources for the bees. Finally, in the autumn, when every thing seems to be exhausted, the black pucerons arrive, which nature has created, to tap the yearling shoots of certain trees, pump out the sap, and deject it for the benefit of the bees.

CHAPTER XXVI.

A VIEW OF SOME OF THE ADVANTAGES DERIVED FROM THE INVENTION OF THE PYRAMIDAL HIVE.

One chief advantage which society owes to the pyramidal hive is, the preservation of the bees. They will subsist for centuries, if they be not destroyed by unforeseen causes, which no attentions could prevent. There is no necessity to destroy, rob, smoke, or transvase them, to obtain their yearly products. They, of their own mere motion and instinct, surrender, annually, to their proprietors, a box full wax and honey, when they descend from the upper to the lower stories, to continue their labours.

Another advantage derived from the pyramidal hive is, that the honey collected in this manner, is always extremely pure. It is not infected by dead bees, nor the old sloughs of the nymphs, nor couvain remaining in the cells, which are always corrupted when the bees are destroyed or transvased by smoke.

If this pure honey be not pressed with the wax, but allowed to flow spontaneously from the cells, there is no doubt it would have much less of that disagreeable taste, which it contracts when pressed from combs filled with *dead bees, old nymphs*, and *couvain.*

It is presumable that this observation will be understood, and it will be readily conceived, that honey extracted in this manner, must be infinitely superior to that furnished by ordinary manipulation, and that it would be much easier to blanch and convert into common or refined sugar.

There is no danger, as some suppose, that a great number of bees, in the same establishment, would suffer for the want of subsistence. M. De Guérapin, proprietor in the department of Aisne, has an apiary of from seven to eight hundred hives, and if there were double the number, the bees would not fail to find their necessary subsistence.

It is still less to be feared, that by following my plan to preserve bees, they would increase to such numbers as to incommode society. This fear is ill-founded. Would to heaven the reproduction of these insects was as abundant as the resources for their subsistence! and commerce would not be taxed every year with an advance of more than thirty millions (francs,) to procure in foreign countries the supply of wax, which religion and luxury consume annually in the empire.

The twenty-seventh chapter contains what M. Ducouedic calls his polemic dispute with MM. Lombard and Bosc, and is of no interest to the American reader.—*Translator.*

POSTSCRIPT.

A RECAPITULATION OF THE PROCESS AND RESULTS OF MY EXPERIMENTS ON THE COUVAIN.

To understand what the *couvain* is, from which nature forms the bee, we must consider it at five different epochs.

First. When the couvain is only an egg laid by the queen, and *not fecundated* by the drones.

Second. When the egg *has been fecundated* by the drones.

Third. When the germ, contained in the *fecundated egg*, passes from *nothing* into *life*, and from which a *worm* is hatched.

Fourth. When the insect *ceases* to be a *worm*, and is metamorphosed into a *nymph*.

Fifth. When finally, this *nymph* undergoes a second metamorphosis, and becomes a *bee*.

These preliminaries concerning the *cradle of the bee*,

should be well understood before we begin to reason on the nature of this insect. We will now develop the picture under these five different points of view.

1st. The egg of the queen mother, before it is fecundated by the drones, contains only an imperfect germ, which can never hatch so long as it remains in that imperfect state. The egg laid by the queen is glued to the bottom of the cell, and the cell is never closed till the egg is fecundated. But, if the egg has been laid after the massacre of the drones, the cell must remain open till spring, after the birth of new drones, hatched in the same hive, from eggs fecundated the preceding year, before the massacre.

But why does this cell remain *open*, from one season to the other? The answer is in the solution of the following observation.

2d. As soon as the egg has been fecundated by the drones, the neuter bees of the interior seal up the cell containing it with a pellicle of wax; and the germ of the insect to be produced remains shut up in the cell.

This waxen pellicle is never broken but by the insect itself, when it shall arrive at a state of perfection.

But the egg which is not fecundated, is not considered by the family as capable of furnishing a subject to the state. This is the reason why the cell which contains it is not closed with a waxen pellicle. This never will be, till the egg deposited, be fecundated by the drones.

3d. The waxen pellicle, which closes the entrance of the cell, is an order of nature, instinctively executed by the bees, for the better preservation of the *individual which is to be produced*.

This individual will rest in that species of tomb during autumn and winter. On the return of spring, the heat of the atmosphere increasing that of the interior of the hive, the egg will ferment, and the germ, passing from nothing into life, will produce a worm.

4th. As soon as this worm comes out of the egg, it forms from its own essence a robe, in which it envelops itself, and no sooner is the robe complete, than the insect ceases to be a worm, and becomes a nymph. But the pellicle, which closes the entrance of the cell, is constantly preserved, and respected by the colony.

5th. Finally, this nymph is scarcely formed before it becomes a bee, and divests itself of its nymphal robe, which

it leaves in its cell. It immediately, of itself, bursts the waxen pellicle, and joins the family, whom it knows, and by whom it is known. It makes essay, is on the wing, and in the fields. This is the manner in which the author of nature forms the bee. While this insect is in the cradle, it requires no kind of nourishment.

But I am not satisfied by reporting this process of nature. I will illustrate it by an experiment, the execution of which is so easy, that the least informed of our country labourers can conceive and put in practice himself.

After the massacre of the drones, there remains in the hive nothing but the queen, the neuters, and the *couvain*, which is to hatch on the return of spring.

In this situation, let the bees be removed by some kind of transvasement into an empty hive, without combs, or couvain. Let them be plentifully nourished with honey. This new hive will very soon be filled with combs, the cells of which, the queen mother will supply with eggs, as fast as they are made.

When spring arrives, drones will be hatched in all the other hives, but none in this. The other hives will produce swarms, but this will produce none. Besides, this hive, which was strong in early spring, every day grows weaker, because it has no productive couvain to repair its daily loss. It will soon come to its end, for want of working bees, as well interior as exterior.

They may be left to perish, and afterwards re-established.—But first let the cells be examined. The queen has deposited eggs in all the cells, but they are all *open*—not one of them is sealed with the *pellicle of wax*, which the bees place over those cells, where the couvain has been *fecundated*, because it is in their instinct, to suspend the application of the pellicle, till the act of fecundation has been performed.

Now this being the law of nature, it is evident that the queen's eggs must be fecundated by the drones, before they are fit for procreation.

For this work of procreation, among the bees, there is no intercourse between the queen and drones.

Bees never place a pellicle of wax on a cell where the queen has deposited an egg, until the egg has been fecundated; and in this, as in all their other operations, their instinct never mistakes.

The fecundated egg, sealed up with the pellicle of wax, hatches at the very time intended by nature, and produces a worm. This worm, thus sealed up, is not in a situation to receive visits or nourishment from (what has been termed) its nurses.

As soon as this worm escapes from nothing into being, it spins a robe, in which it wraps itself from head to tail, so that no members, neither feet nor claws, are to be seen, and it can neither walk nor move.

This worm, thus enveloped, can neither eat nor drink; and as soon as its robe is spun, passing from the state of worm to that of nymph, it can have no appetite.

The change of this insect, from the state of nymph to that of bee, takes place the instant the robe is finished; when it immediately strips it off, bursts the pellicle of wax, joins its companions, and flies to the fields.

It is therefore demonstrated, that whatever metamorphosis the couvain undergoes, from the egg to the bee, it is operated on by the immutable order of nature. And as we owe all these changes to the law of nature, the eggs, where the insects have perished in the hive, may be *hatched* without the aid of bees, nurse, or nourishment, when nature has furnished the two grand essentials of hatching, viz. fecundation by the drones, and atmospheric warmth, on the passage of the sun from the sign of cancer to gemini.

But let us return to the hive which we have seen perish, and let us resuscitate and make it more brilliant than before.

This hive may be re-established, by catching some drones from another family, as they come out or go into the hives. They must be confined in a cone of paper, till night. They must then be introduced into the dead hive, where the eggs are yet unfecundated. These drones find the eggs, and instinctively fecundate them; and the sun will cause them to hatch, although the cells be not sealed, and cannot be sealed, because as yet, there are no working bees to perform the service. Such is the force of the power of nature.

But there is another mode, infinitely more profitable for the proprietor. That is, to set this hive on the top of another, in which a new swarm is just housed; this instantly forms the Scottish hive.

The drones of this new swarm will soon fecundate the eggs in the upper box, and the neuters will seal the cells

with the waxen pellicle. The family will rapidly increase; and before the end of the season, the combs will be filled with honey. Thus this hive, having served for a demonstration of the phenomenon in question, will become pyramidal in the spring following, and afford a full harvest, the autumn of the same year.

DUCOUEDIC,

Of the Society for the Encouragement of National Industry,
Of Agriculture,
And many other learned societies.

THE END.